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The Meter Trend

Influence of the Act

WE are not quite happy at seeing in the survey of meter developments in this issue the continued endeavour being put into the production of testing equipment without an intensification of effort with regard to the development of the meter itself. Is there not a risk of the meter-engineering mind becoming so obsessed with the testing side that the meter itself may be neglected from other aspects, such as maintenance? After all, the testing equipment is only a means to an end, and the end in this case is the perfect meter.

The Meters Act has now been functioning for some months, and we can begin to see some of the results. The first is that the considerably increased powers bestowed upon the Electricity Commissioners, in addition to the requirements of the manufacturer, the supply undertaking and the consumer, have changed the whole face of the meter section of the industry.

Recent Changes

Is this a change for better or for worse? To get the right perspective in answering this question, let us consider the developments from a few years ago, say just after the establishment of the Meter Engineers' Technical Association. Then we had a period during which while some undertakings operated with properly organised and equipped meter departments, others grudged expenditure even on a stop watch.

In this period when the high-quality manufacturer had to grapple with the serious situation brought about by cut prices it was a common happening for a new model of a meter to be introduced to the market before its predecessor had been adequately tried out in actual commercial service; and the tendency to introduce all sorts of fancy tariffs, gave the manufacturer a good run for his money in making special meters to suit such tariffs.

Then came the time immediately following the publication of the McGowan Report with its recommendation that a two-part tariff should be available to every consumer which resulted in an enormous increase of public interest in the two-part tariff meter. That era was followed by one of uncertainty as to what the position of undertakings would be if and when the Distribution Act—anticipated as the result of the McGowan Report—was brought into being, coupled with the tendency to leave the meter to look after itself for a bit and get on with establishing testing stations and equipment. When the Meters Act was brought into force considerations of the possible results of the McGowan Report came more and more to be placed at the back of the mind. An immediate repercussion, human no doubt, was that various "parties to the pact" got obsessed with the idea of accuracy, and meter operation of a precision that was ridiculously different from the limits of error laid down by the Commissioners was expected; but common sense is prevailing again and there are something like 600 well-equipped supply undertakings' stations in this country in which meters are receiving, or soon will receive, the required testing and certification.

Manufacturers are finding relief from the close competition of a few years ago, if only because of the time-lag in getting meters officially approved, and they are working along accepted lines and can pay more attention to quality on which those dominating "limits of error" depend.

Is it not the fact, then, that all concerned are benefiting, and will benefit, from the passing of the Meters Act? The Act may be considered as one step farther in raising the status of the supply meter engineer; as enabling the undertaking to get a meter of better quality; as a means of making it easier for the meter manufacturer to keep up the quality of his wares; as a service to the consumer similar to that performed by the Weights and Measures Act and adding still further to the prestige of the Commissioners.

Manufacturers may have a special harvest of their own, for the replacement of meters which have to be taken out of circuit and which do not satisfy the Commissioners' requirements will probably offset the decrease in output which had already started and would probably have continued, owing to the slowing up of operations in the building industry. Of course, everything will not go with a swing for a long time, and many existing stumbling blocks will have to be got over. For one thing, thousands of meters taken out of service will have to be handled and somebody will have to decide which of them is to be retained and repaired and which shall be scrapped.

The supply section still has a few more months in which to regularise its testing arrangements, *i.e.*, before the expiry of the "temporary approval" period.

Interconnection and Bulk Supplies

IN order that the lessons of recent electric supply failures may not be lost it is essential to distinguish between two principles. The first is that of interconnecting power stations for the purpose of providing reserve capacity as well as of generating the greatest number of kWh by means of the most efficient plant. The second is the giving of bulk supplies, which in effect increases the size of distribution areas. The application of both principles has been the commercial policy of supply undertakings in all parts of the world for more than thirty years as well as the statutory duty of the Central Electricity Board. If, as there seems reason to suppose, the number and length of interruptions in supply—and not merely the amount of public attention paid to them—has increased of recent years, the causes should be thoroughly and methodically investigated by an expert committee. Such an investigation should also consider the possibility of attack by hostile aircraft. In regard to the latter, interconnection of generating stations should have much the same result as it has in normal times; *i.e.*, it should prevent any important industrial area from being without supplies for an extended period. Bulk and emergency supplies present other problems, and our criticism of present layouts of control and connecting points of any form of supply undertaking is that they do not always permit adequate use to be made of the grid or other resources in the event of local trouble. Failure of equipment cannot be entirely ruled out, but the faulty item should be cut out of circuit without involving the whole system.

The Kingston Affair

IN the case of the recent interruption in the supply to the Thames Valley, a small station was serving a compact area. So far conditions would appear to approximate to those considered desirable by a correspondent in this issue, as fault current was limited by the buffer effect of transformers between the 3.3-kV generators on one side and the 33-kV system (itself transformed from the 132-kV grid) on the other side of the 11-kV board where a fire occurred. Neither here nor at Bradford, the other classic instance, was the fire due to failure of a circuit-breaker to clear a short-circuit. In any event our correspondent is entirely mistaken in supposing that we have suggested that switchgear is not available that would rupture a very severe fault current, let alone one of the relatively small value possible at Kingston. The point at which the similarity with the self-contained small area ceases is that it was fortunately possible on this occasion to resume supplies by connecting up with the grid. A longer interruption would have been suffered but for the availability of spare equipment, some of which was lent by other undertakings. This indicates the need for the national reserve of transformers and switchgear which the Ministry of Transport has decided upon. Its existence would not, however, have made much difference at Kingston where, but for the "bottle-neck," the bulk supply to the J.E.A. would have been only slightly affected.

Hire-purchase or Credit Sales?

IN his article in this issue dealing with the position of electricity supply undertakings in relation to the Hire-Purchase Act, Mr. E. C. Mekie manifests a poor opinion of the electricity consumer. He believes that a cooker, for example, supplied under a hire-purchase agreement would almost automatically be returned to the supply authority when the consumer had paid half of the cost, as the Act requires him to do, so that he could get a later pattern and repeat the operation *ad infinitum*. The average man would surely consider it very bad business to pay hire-purchase terms for what is in effect simple hire and, in any event, would the supply authority be compelled to play this game? However that may be there will always be found some people whose moral sense (not to say common sense) withers when brought into contact with a public authority, and although hard cases make bad law arrangements must be made with them in view. Mr. Mekie puts forward the credit sale agreement as a better alternative to hire-purchase—the spirit is the same but the form is different. Electricity supply undertakings are placed in a privileged situation and so the author considers that the cumbersome hire-purchase method should not be adopted. A form which Edmundsons Electricity Corporation has evolved is recommended for general adoption.

A Pause at Manchester

THE Manchester trams are, after all, not going to be abandoned without a further effort to secure a better show for the trolley-bus. The special sub-committee appointed to deal with the matter prepared a report generally approving the original proposals, but the decision to pass its report on to the General and Parliamentary Committee was actually made by only three of the twelve members, which indicated a certain diffidence. This was noted by the General and Parliamentary Committee, which decided to refer the report back to the sub-committee with directions to go further into the matter of the comparative costs of trolley-buses and oil-engined vehicles.

Belfast's Decision

THE decision of the Belfast Corporation to replace its trams by trolley-buses may help Manchester to view the electric vehicles in a more favourable light. The process is to be a gradual one, but eventually a sum of well over half-a-million pounds will be expended. The step is being taken after experiments extending over a period of nine months during which time the trolley-bus has proved itself an admirable vehicle for a populous city. As we have said before, the financial difference between the two systems is insufficient to counterbalance the undoubted advantages of the trolley-bus in the way of increased travel comfort, ease of operation and independence of imported fuel.

The Modern Plug

THE improvements which have been made in plug and socket design are highly commendable, and the adoption of standards by the leading manufacturers not only removes the dangers of uncertain contact, but eliminates also many of the causes of electrical interference with the broadcast receiver. There is, however, considerable effort now required to insert or remove a three-pin power plug from its socket. It is probably unavoidable that this should be so if reliable contact is to be obtained; but has sufficient attention been given to the attachment of the socket to the skirting board or other fixing place? Too often the method of fixing, adequate when the plug fitted easily and loosely in its socket, now no longer stands up to the added strain and the socket loosens from its fixing, an indication that whilst the design of the plugs and sockets has been improved the method of fixing has not received equal consideration.

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Meters and Time Switches

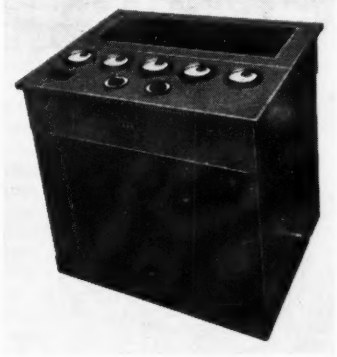
Developments in design during the past twelve months

The most important event during the period now under review has been the putting into force of the requirements of the Electricity Meters Act, insofar as it governs the actual certification of meters. Accordingly, the industry has been largely preoccupied in dealing with the very many questions which have been raised as a consequence of the changed conditions.

IN our corresponding issue last year we referred to the unique position in the meter world brought about by the combination of the then recently introduced Meters Act, the 1937 revision of B.S.S. No. 37 and the period of suspense pending the probable introduction of a Bill after the McGowan Report, which, superficially, suggested a slowing-up of development of meters proper. We also predicted that when the new requirements were put into force after the "appointed day" a stabilisation of ideas would result from the change of outlook.

There is evidence that the prediction referred to was correct, for although meter-testing equipment and meters for testing purposes still take first place in the new production in this sphere, the slowing-up with regard to the development of meters proper has been arrested, and with it the somewhat haphazard development of "gadgets" which were largely the result of personal predilections in the "uncontrolled" field of fierce competition.

It is true that the back-to-normal movement may be due partly to the removal of uncertainty about the immediate future brought about by the indefinite postponement of the introduction of the Distribution Bill, but we suggest that it is due more to the feeling of security which is spreading among meter engineers as the result of a badly needed measure of control which has given the supply man a goal to aim at and the manufacturer a more definite idea of what will be wanted for the future.

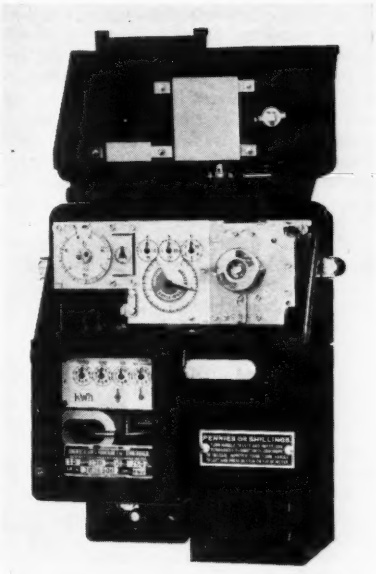


A.E.G. valve controlled constant-voltage cabinet for test rooms with only one testing set

In predicting the stabilisation referred to we also said that one of the important results would be a reduction in the number of sizes of meters. The Electrical Apparatus Co. says that during the past year the tendency to employ meters of larger capacities has been very noticeable, doubtless due to the wider adoption of two-part tariffs. In fact, whilst the demand for meters of 2½-A and 5-A capacities has fallen very considerably, the company has experienced an extraordinary growth in the demand for its 25-A "Straight Six" meter, both in the ordinary pattern and in the two-part tariff prepayment form.

With regard to meters proper an important and early repercussion is the development by Chamberlain & Hookham, Ltd., of a prepayment meter in a divided case. It has been introduced, the company says, to obviate one of the petty annoyances involved in the practical working of the Act. Should it be necessary after the installation of a meter to break the seals for changing the price per kWh or for any other purpose, the meter must be resealed by an authorised official and a declaration that the accuracy of the meter has not been affected by the work done on it has to be submitted to the examiner in order that the certification and the meter may still hold good.

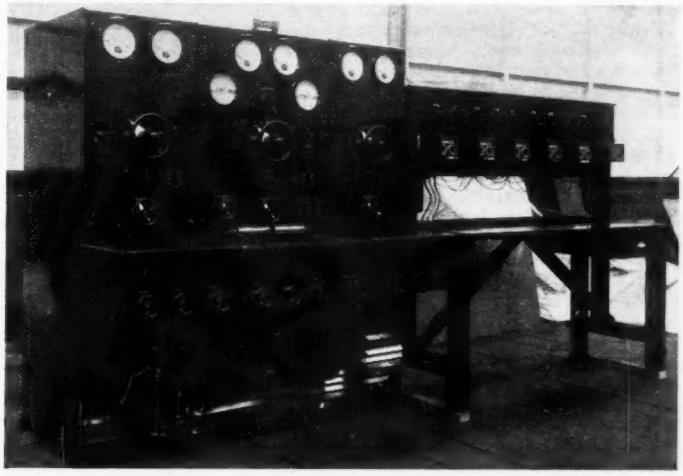
The moulded meter case is therefore divided into two compartments, one of which encloses the meter element, while the other contains the prepayment mechanism and the rental attachment. When the main cover is in position and sealed the meter element is completely inaccessible. The upper part of the main cover has a hinged portion which can be lifted to expose the prepayment mechanism. If desired, the mechanism can be removed or exchanged on the consumer's premises without interfering in any way with the meter element. The mechanical connection between the counting train and the coin freed portion is by means of a wheel in the counting train, which projects through a narrow slit in the partition dividing the case. Only the edge of the wheel is visible and this meshes with a corresponding wheel in the coin freed portion. When the hinged portion of the cover is closed it is secured by means of a separate seal or by the padlock on the coin compartment, at the option of the supply authority.



C. & H. prepayment meter in divided case; hinged part of main cover open

The meter can be supplied with or without the rental attachment, but the latter can be added in a few seconds if required at a later date. Dowel pins ensure correct alignment of the gears and no skill is required in this operation. The electrical connection is made by two pins and sockets. The prepayment mechanism operates with pennies or shillings or both, and the price per kWh can be altered in an instant by the simple exchange of a gear unit which clips in position.

For the moment the greatest influence of the Meters Act is felt in connection with the provision of testing facilities which will meet the requirements of the Electricity Commissioners. As a help in obtaining a correct perspective in this exceedingly important matter, however, we strongly recommend a perusal of the paper "Organisation of a Meter Test Department of Large Supply Undertaking, with special reference to the Electricity Supply (Meters) Act, 1936," presented to the Institution of Electrical Engineers by Mr. C. W. Hughes, B.Sc. He outlines the methods of testing permitted by the Commissioners. Method A provides for long-period dial tests in conjunction with sub-standard rotating meters, method B allows for testing by comparing the speed of the meter disc directly with that of the rotating sub-standard meter at the specified loads, and in method C meters may be tested by holding the load steady at the specified loads on an indicating wattmeter and timing the disc revolutions by means of a suitable timing arrangement.



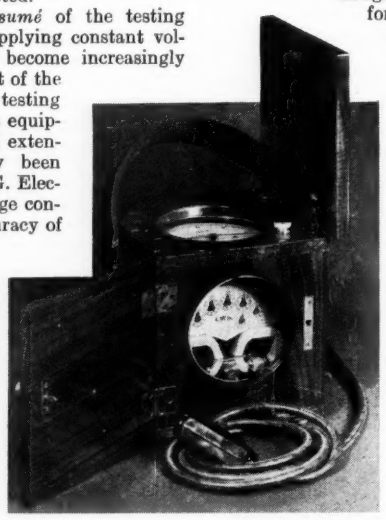
Ferranti three-phase meter-testing set and bench

Mr. Hughes points to the advantages of method A over methods B and C as a means of ensuring accuracy, but he shows that where only a few meters of the same type are dealt with at once the latter methods are more economical.

Thus a case is made out for the standardisation of sizes and types of meters bought by an undertaking and even for the amalgamation of small test rooms to form one of a size such that method A can be economically adopted.

It seems evident from the above *résumé* of the testing requirements that the advisability of supplying constant voltage on meter testing equipments will become increasingly important and will be looked upon as part of the standard equipment of an up-to-date testing room. A valve-controlled constant-voltage equipment designed for this purpose and used extensively on the Continent has recently been introduced into this country by the A.E.G. Electric Co., Ltd. Designed to hold the voltage constant from zero to full load with an accuracy of ±0.05 per cent. for mains voltage fluctuations of ±5 per cent., it is available in different constructions for use according to the number of testing sets it is required to serve.

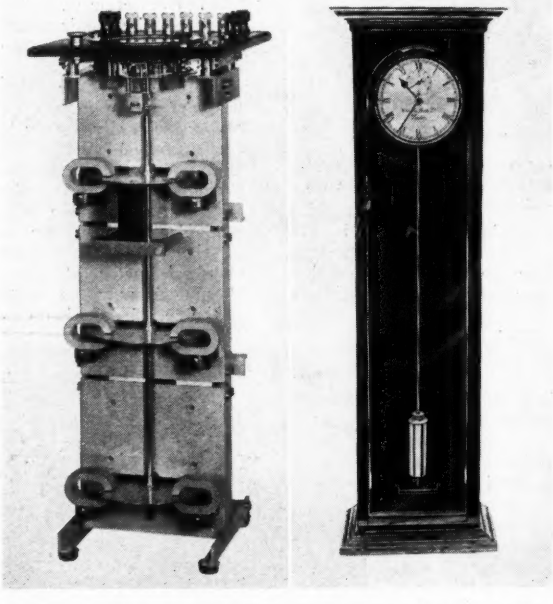
Type "M" is intended for use in test rooms with one testing set only for AC, single-phase or polyphase meters. It consists essentially of a control table with all the necessary instruments and switches, an amplifier, a polyphase synchronous transformer, a polyphase synchronous motor and a polyphase synchronous generator. The motor is push-button controlled and applies the voltage across the motor selector switch. An exciting generator delivers exciting current to the synchronous motor when the polyphase generator delivers polyphase voltage which is a little lower than the nominal voltage. The phase voltage is converted to DC by a rectifier and this DC voltage is compared with a normal voltage delivered by a "Stabilovolt" (constant voltage) tube. The equipment is available in sizes up to 10 kVA and for voltages up to 500. In test rooms with more than one testing set it is not sufficient to keep constant three of six voltages of a complete three-phase system, so that in the type "MGO" equipment the feed voltage is rendered symmetrical, *i.e.*, all six voltages are maintained constant in magnitude and phase without material additional expenditure.



Portable single-phase sub-standard meter (Ferranti)

For testing three-phase meters on each of the phases individually, Ferranti, Ltd., have introduced a testing set and bench which is available in standard sizes of 100, 500 and 1,000 A. Control of the current and voltage circuits is by means of moving-coil regulators and coarse and fine adjustment is provided on each regulator by a lead screw motion. Group control of the power factor is obtained by means of a three-phase shifting transformer, but additional small power factor adjustment is provided in each phase to obtain an absolute balance of p.f. in varying load conditions. Power factors of 0.5 lagging can be obtained on each phase by displacing the current by 60 deg. with respect to the voltage, so that it is possible to test meters at unity p.f. on one or two phases and at 0.5 p.f. leading on other phases. The current transformer ratio switches are arranged so that the ranges on the current supply transformer and the precision current transformer are changed simultaneously.

A s.p. meter testing set for meters up to 100 A and 500 V has in the voltage circuit a moving-coil regulator to give coarse and fine regulation of the testing voltage. In the current circuit is a multi-tapped current supply transformer, and the load control is obtained by a sectionalised resistance bank, each section giving approximately a certain percentage of the full-load current. Two slide-wire resistances afford fine adjustment of the load current. A variable inductive resistance provides for testing meters at 0.5 lagging p.f. The set is primarily intended for testing meters against a rotating sub-standard meter, but with the addition of a precision current transformer and sub-standard indicating wattmeter, stop-watch tests can be taken against these.



Left: Measuring elements of C. & H. three-phase, four-wire, three-element meter. Right: Venner master pendulum clock

Two new portable testing meters have been developed by Sangamo Weston, Ltd. Both meters are suitable for long period dial testing, as they include kWh dials in addition to the usual disc revolution dials, and both sets of dials have resetting devices. One of these meters is a single current range type suitable for use with an external class "AL" multi-range current transformer and the other is a self-contained multi-current range pattern. The standard pattern of both meters is suitable for operation on 115/230 V and an external multiplier is supplied for higher voltages up to and including 440 V.

Again, the influence of the Meters Act is still felt in connection with the production of sub-standard meters. A line of C. & H. precision-grade AC watt-hour meters has been developed. A s.p. wall meter with one current and one voltage ranges has a counter registering either in kWh or revolutions of the rotor. In a similar portable unit the counter reads kWh on one set of dials and revolutions of the rotor on another set. A s.p. portable meter has one or two voltage ranges and six current ranges up to 50 A. A three-phase three-wire portable meter has one current and one voltage range, and a three-phase four-wire, three-element portable meter has a similar arrangement.

All the portable meters are provided with two sets of dials for registering kWh and revolutions of the rotor, respectively, a resetting device being provided for the latter. In the s.p. portable meter with one current and one voltage range is a small current transformer with a nickel-iron core. Several primary windings are suitably disposed on the core and a single secondary is connected directly to the meter current coil. This coil is wound for 5 A, but the meter is not intended for use independently of the transformer, so that the 5-A range is wound on the transformer. The result is a considerable increase in overall accuracy in a multi-range instrument.

Ferranti, Ltd., have recently introduced a portable testing meter (type "PFR") which is available only as an s.p., two-wire unit and is usually supplied as a 5-A rating with a precision current transformer to provide as many current ranges as are required. Up to three voltage ranges are obtainable by means of a variable impedance in series with the pressure coil of the meter. A horizontal register for revolution tests has a large pointer mounted on an extension of the rotor spindle, together with two small inset pointers to read up to 99.99 revolutions. All three pointers can be instantaneously reset. For long period tests there is a separate register consisting of a six-dial pointer train reading in kWh. A switch provides for the interruption of the potential circuit to stop and start the meter. Practically no modifications of the Weston precision indicating instruments have been necessary to meet the requirements of the Act except that the shielding of the model "5" voltmeter has been improved to bring the instrument well within the accuracy required by the Act.

The close degree of accuracy in measurement called for in the certification of meters has resulted in increased use being made of precision current transformers, and among the many new designs produced for this purpose the C. & H. portable multi-range precision unit is noteworthy. It has a nickel-iron core with two primary and one secondary windings. Each primary is divided into four sections which may be connected in series, series-parallel or parallel, thus providing three current ranges. Links provide for easy changing of the ranges. By careful disposition of the primary windings on the core

the error is identical in every range and consequently it is unnecessary to make corrections in the meter or instrument readings according to the particular range in use.

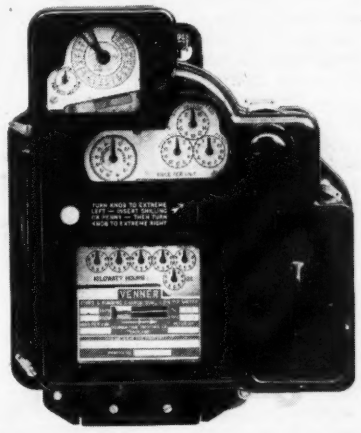
Two new Sangamo multi-range current transformers suitable for use with sub-standard instruments have the B.S.S. class "AL" accuracy standard rating of 7.5 VA, with insulation of the primaries suitable for voltages not exceeding 700 to earth. There are eight wound primary current ranges up to 100 A, while the secondary current ranges are 1 A and/or 5 A. A rotary switch facilitates changing from one primary range to another. One of the types of instruments is suitable for inserted turns by means of which primary ranges up to 1,200 A can be obtained.

Venner Time Switches, Ltd., tell us that the advent of the "appointed day" led to a heavy demand for their master pendulum clocks and stop watches for test-room equipment. The hand of the type "A19" Venner stop watch goes round the dial in ten seconds instead of the usual 60 seconds, so that the scale is increased by six times and is therefore unusually open. The scale is marked off in tenths of seconds, thus enabling readings to be taken to two places of decimals with ease.

Metrovick AC prepayment meter with dual-coin receiver

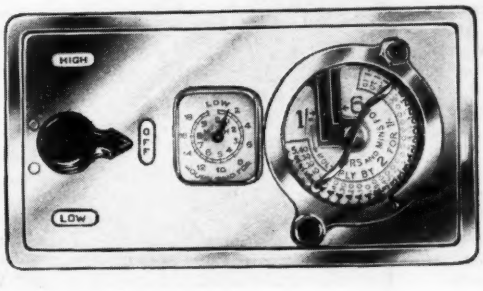
For a few years before the passing of the Meters Act we had to repeat that practically all new developments pertained to auxiliary attachments for prepayment meters to cater for various tariffs, tariff changes and denominations of coins. Apart from the overwhelming influence of the Meters Act the position with regard to meters proper is relatively still the same, although, in the main, there are fewer developments in spite of the slight "revival" since the "appointed day."

Probably the most interesting developments in the prepayment-meter field are those which provide for the conversion of meters from one type to another. In the two-part tariff prepayment meter produced by Smith Meters, Ltd., for instance, the removal of the fixed-charge collector immediately converts the meter into an ordinary prepayment meter, and *vice versa*. The "secret" of this simplicity lies in the fact that the collector, in common with other components of the equipment, is a complete and self-contained unit, and when it is inserted into the meter it automatically engages with the prepayment mechanism. A new prepayment meter which Rex Meters, Ltd., expect to put on the market about next March will be suitable for conversion to a two-part tariff meter. It will have an easy price-per-unit change device and a simple and robust three-coin mechanism.



Venner infinitely variable two-part tariff AC prepayment meter

Another outstanding achievement in connection with prepayment meters is the mechanism for collecting arrears, not only because it gives the lie to the assertion that in the production of such delicate "gearing" the British engineer has to take second place, but also because of the help it affords in maintaining good relations between the supply undertaking and the consumer because of the great convenience it provides for both parties. In the Smith Meters mechanism the keynote is again simplicity. Whenever the consumer falls into arrears with his fixed charge, the power from the synchronous motor is automatically transferred to a spring which is wound up in proportion to the amount of the arrears. By a simple setting the effects of the synchronous motor and the unwinding of the spring become additive and the consumer pay off the accumulated arrears at the same rate per week as the fixed charge, the kWh rate remaining unaltered.



Smith Meters mechanism for incorporating in hotel electric fire

British Electric Meters, Ltd., have made some important contributions to the development of fixed charge collectors. The collector unit of the type "O W B" two-part tariff prepayment meter is so arranged that such features as springs, ratchets and pawls, and the use of gravity are eliminated, with the result that both its construction and the method of alteration to the fixed charge are extremely simple. The unit can be set to collect in farthing and halfpenny steps up to 10s. per week and the simple screwdriver adjustment is made positive by a rotating pointer. In addition, this unit incorporates an indicator which shows whether or not the synchronously operated motor is running. The prepayment mechanism is available in single- or multi-coin types and the designers have embodied many useful features such as an "in" and "out" switch indicator and a mechanical locking device which preserves any reading or credit on the meter when the price-change gear is slackened prior to removal.

Another fixed-charge collector development is the "N B" collector which consists of the "O W" prepayment mechanism and "O W B" collector unit. Its purpose is to collect a weekly charge and it can be installed where a flat-rate prepayment or quarterly meter is in existence to obviate the expense of fixing a two-part tariff meter. It is also suitable for use on electric fires which are charged for on a set amount basis. It is arranged so that the arrears dial does not come into operation and once the switch has tripped a further coin has to be inserted before the fire can be used. A hotel-fire mechanism introduced by Smith Meters is provided with the usual variable tariff feature and is of the dual-coin type. It is intended for one size of fire only (2 kW) and the control switch is of the double-throw type which connects alternatively one or two heating elements into the circuit and, at the same time, mechanically alters the gearing of the drive to correspond.

The popularity of the multi- or optional-coin prepayment meter continues and Ferrantis tell us that their outstanding development during the past year has been the introduction of the "F.L.P.B." optional-coin prepayment meter, which provides for the insertion of pennies and shillings. The company's small-gap switch is incorporated and there is a differential system operated positively on one side by the coins inserted and negatively on the other side by the rotation of the meter disc. The amount by which the positive side of the differential is rotated is automatically governed by the denomination of the coin inserted.

After a coin has been inserted in the appropriate slot, pressure on a push button on the meter causes the coin to be moved along with the push-button assembly. When it is moved a certain distance the coin comes into contact with the end of a push rod and further movement of the push button causes a similar movement of the push rod with a resultant positive rotation of the differential. The coin is then automatically released and the push button resumes its original position. Another push stem is used for actuating the switch mechanism. The prepayment mechanism of the new s.p. meter of Siemens Electric Lamps & Supplies, Ltd., can be arranged for single- or dual-coin operation.

The Metropolitan-Vickers Electrical Co., Ltd., says that the continued demand for dual-coin mechanisms has been met by making such mechanism available on more of the company's standard patterns of prepayment meters. In some single-

coin meters provision is being made for substituting a dual-coin receiver on site and in other instances a rent-collecting mechanism can be added when the need arises. The "R.U.I." meter has been developed because of the demand for a combined rent and kWh meter arranged for optional-coin (penny or shilling) operation. It is fitted in the same case and cover as the "N.E.I." load rate and "D.M.I." prepayment meters and has a similar coin box. An improved feature is a large range prepayment scale of £1 prepaid and £1 owing. A coin register is scaled up to £10 and the rent attachment is of the standard type.

E.A.C. prepayment meter showing "Straight Six" meter element

Whether the meter is required for one, two or three coin operation is a matter of selecting the appropriate coin action in the case of the Smith Meters unit. The actual construction is the same in every case, so that only one form of mechanism has to be manufactured. The coin mechanism is a complete unit in itself and the company stresses the absence of complications for either the engineer or consumer.

Venner Time Switches say that the two-part tariff prepayment meter scheme of charging has made considerable progress if one is to judge by the many supply authorities that have introduced this scheme during the past twelve months, and they cite the dual-coin equipment as one of the developments associated with the progress of the scheme referred to.

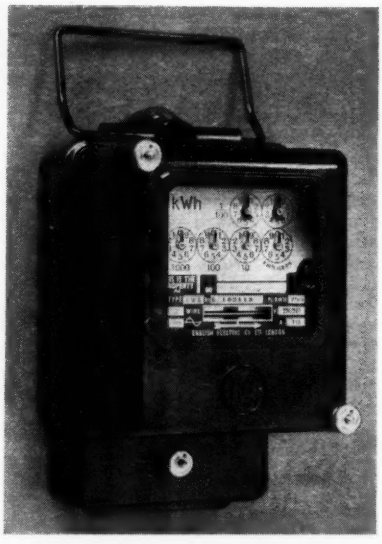
Another question which is being given greater attention as the result of the Meters Act is the necessity for being able to calibrate meters closely and to rely on that calibration remaining constant. In this connection the E.A.C. has further developed the use of the "Straight Six" meter element which has been incorporated in all sizes of the company's various types of prepayment meter, as well as in the ordinary quarterly meters of 20-A capacity and more. The high torque of this meter element (over 6 gm. cm.) in conjunction with a flat characteristic curve is naturally of great value, especially in prepayment meters, in ensuring stable performance, particularly on low loads.

We have heard few references to the "long-range" meter as compared with a few years ago, but an exception is the new 3-A Rex single-phase meter which has just received the Electricity Commissioners' approval. This meter has a smaller back-to-front dimension than the company's present single-phase meter, while other improvements are two magnets instead of one, finer low-load adjustment and a temperature-compensating device.

The bakelite *versus* metal case controversy of a few years ago seems to have died out, judging by the manner in which manufacturers refer to the adoption of bakelite cases for new meters as something quite normal. For instance, the new Rex meter just referred to has a bakelite case and Venners refer to the adoption of the bakelite case as an optional alternative to the cast-aluminium case for the whole of the company's meter range. The Metrovick DC Ah meter, type "D.M.," is now available in a bakelite case for both quarterly and prepayment patrons, and the company says that this change of material reflects the widespread tendency to make all electricity meter cases of moulded insulation. In this connection we are reminded of the meter cases which we saw being moulded on the electrically heated presses during a recent visit to the works of E. K. Cole Co., Ltd.

Among the more detailed work which is taken in the stride, as it were, in connection with ordinary house service meter development is that in connection with meter bearings, and the English Electric Co., Ltd., refers to the optic axis of jewels as a problem which has been demanding the attention of research engineers. The company has been fortunate in procuring a suitable microscope for studying such work, and as a result it can now supply jewels cut with the optic axis at the correct angle relative to the jewel cup which supports the weight of the rotor. Magnifications up to 330 diameters have been obtained without revealing any signs of jewel wear after more than 200 million revolutions of the rotor. From this the company estimates a life of twenty-five years for its standard ball-type bearings.

The fact that the prepayment meter switch is the last link in the chain between the supply undertaking and the consumer stresses the importance of this component and we extract from Smith Meters' literature the following requirements of the ideal switch. It must be able to carry heavy overloads, operate with clean makes and breaks, maintain a high constant pressure and trip without sluggishness. Precision in action and perfection of contact are claimed for the switches incorporated in all the company's prepayment meters. In connection with its large capacity prepayment meters the E.A.C. focuses attention on switch performance. Standard designs provide a liberal factor of safety and the contactor-type switch is so conservatively rated that even a life test of 2,000 operations at 65 A and 250 V has failed to increase the contact resistance or to render the switch unfit for service.

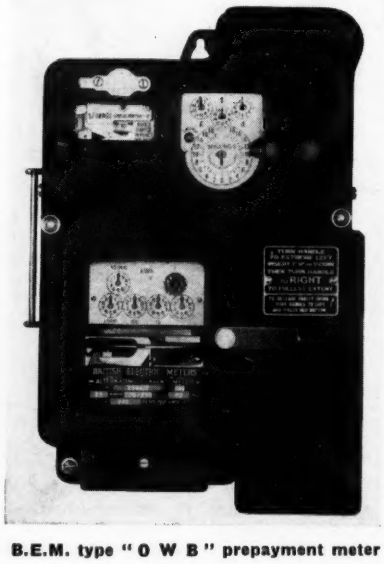


English Electric quarterly meter in bakelite case

For the larger industrial and commercial consumer and the bulk supply undertaking maximum demand indication and limitation are becoming increasingly important, and the following notes show that manufacturers are alive to the new conditions. A recent introduction of Aron Electricity Meter, Ltd., is the "Hill-Shotter" kVA maximum demand indicator of the declared voltage pattern. The fundamental principle of operation has not been changed from that of the older type, but such modifications as size and weight reductions, simplified construction, electrical loss reduction and synchronous-motor tripping have been made.

The essential working parts are the rotating element, the driving electromagnets, the permanent magnet and the m.d. indicator mechanism. The rotating element has two aluminium rotor discs mounted on the main spindle. The electromagnets are bolted on the sides of the frame and so disposed that in the 3-phase model one operates on the upper disc while the other two operate on the lower disc, at opposite sides. The permanent magnet is carried on a projection from the supporting frame while the indicator mechanism embodies some novel features such as completely self-contained construction, including the tripping motor, an auxiliary drive motor for relieving the rotor of mechanical burden, a special tripping device giving a very short disengagement period of the driving pinion and facility for hand setting the phase of the tripping period.

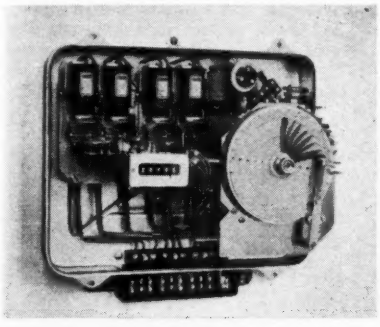
When the electromagnets are energised by currents in the windings in series with the load a driving torque is set up. The speed of rotation is controlled by the permanent magnet, while there is a self-braking effect from the electro-magnets. The combination of



B.E.M. type "O W B" prepayment meter

these braking effects, the two constituents of which are equal at full load, results in a straight-line law for the "speed of disc to load" curve above 1/5th full load and in the corresponding uniform graduations on the indicating scale of the indicator mechanism. Thus the actual measurement is that of the average ampère m.d. and the demand indicator scale is graduated to indicate kVA by taking into account the value of the declared voltage of the system.

The new Sangamo m.d. meter operates on the thermal principle, measuring a continuously progressive demand according to the heating effect of the energy consumed upon the capacity of the



Londex maximum recorder with totalising equipment

supply system. The meter is self-contained and is available in six sizes up to 80 A. Where the voltage of the supply may be assumed to be constant at the declared pressure, the meter may also be used as a demand kVA or a demand watt-meter, and in such cases the dial is scaled according to requirements. The meter is suitable for use on AC or DC circuits and its design is simple and robust.

A m.d. indicator with a selective form of alarm device has recently been evolved by Metropolitan-Vickers. The demand measuring period is sub-divided into a number of smaller ones, and by means of vacuum-type relays the alarm, should it be given during the first or second 10-minute intervals, lasts for only a short

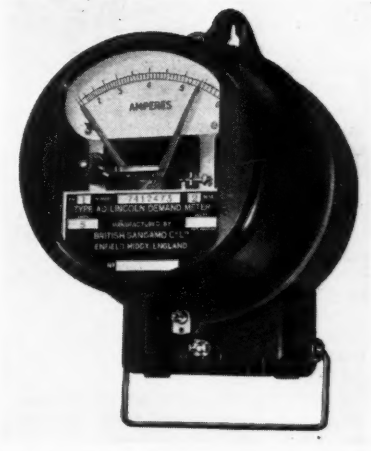
Aron declared voltage maximum demand indicator

preset time. If, however, the alarm is given during the final period it is arranged to be continuous until such time as steps are taken to reduce the demand.

In these days of bulk supplies summation metering is a growing necessity and an example of what is being done to meet the requirements is the C. & H. industrial summator, which is designed to depict the load in kW on three feeders. A contact-making device on each feeder meter sends an electrical impulse to the summator each time a definite quantity of electricity has been consumed. The impulses are registered on three counting trains and a fourth counting train registers the total of the impulses received. The demand indicator also receives the whole of the impulses and is geared to read directly in kW. The maximum recorder introduced by Londex, Ltd., is fitted with totalising relays and gear to record the maximum demand of the total of four measuring points. The pointer on the disc completes its record every quarter- or half-hour and then the disc moves into the next position and a new record is made.

A metering unit for outdoor high-voltage work has been developed by Chamberlain & Hookham and is intended particularly for the metering of supplies through branch lines. It houses in one tank all the transformers necessary for metering the supplies and is suitable for pole mounting. The meter proper is mounted at the base of the pole and has a suitable weatherproof housing.

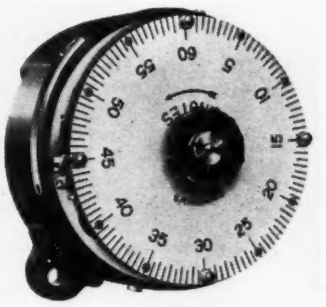
The increasing use of time-switch equipment for industrial purposes has brought about a need for more definite classification of such apparatus and we feel that the definitions given by Everett, Edgcumbe and Co., Ltd., are very satisfactory. They refer to the two classes



Sangamo thermal demand indicator

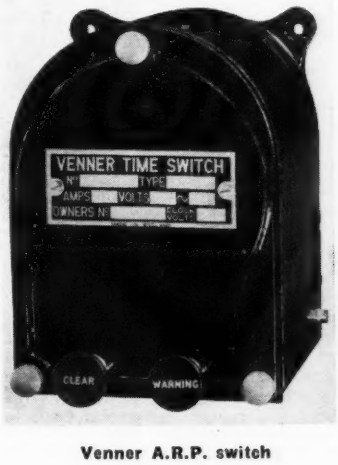
of timing devices as (1) those which open or close a circuit at the end of a given time, and (2) those which operate continuously, carrying out a definite sequence of switching operations. A recent adaptation of the first class of timers has been extensively used for the timing of the annealing process in a large steel works. The closing of the doors starts the timer which, at the expiration of the preset time, shows a warning light, followed, after a further short interval, by a signal indicating that the annealing time has elapsed and that the metal should be removed from the furnace.

The British, Foreign & Colonial Automatic Light Controlling Co., Ltd., finds that for street lighting and ordinary purposes the switch size is a leading factor, and although in the past year the company has put on the market its "G.R." switch which measures only about 3¼ in. by 3½ in. (10 A) it is now producing an even smaller model which, it is believed, will be the smallest time switch capable of carrying 10 A. The company also finds that synchronous-motor equipment is in greater favour than a year ago and it predicts that the greatest demand in the future will be for the synchronous modes with solar dials.



Sangamo "SSK" time switch

Many uses have been found for the C. & H. synchronous motor, including time-switch driving. It is 1¾ in. in diameter and 1⅞ in. long. It consists of a mild-steel cup having a hollow core in the centre surrounded by a coil of fine enamel insulated wire. An outer pole plate with radial poles projecting inwards is placed on top of the coil and rests in a recess in the edge of the cup. An inner plate with radial upturned poles fits on the end of the hollow core and is riveted in position with its poles equidistant between the poles of the outer pole plate. A rotor consisting of a flat cobalt steel stamping is mounted on two pillars secured to the outer pole plate and carries the the top bearing screw. The bottom bearing screw fits in the lower end of the hollow core and the rotor spindle runs between these bearings and through the core. The loading is 1.75 W, the starting torque is 7.3 gm. cm. and the running torque is 23 gm. cm.



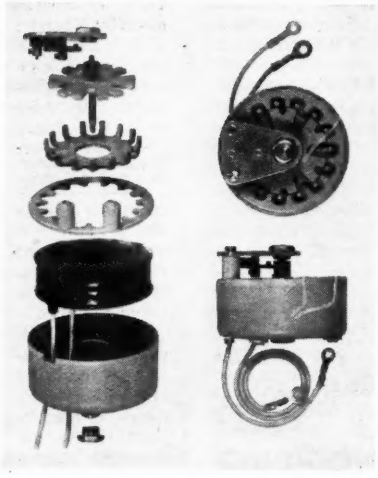
Venner A.R.P. switch

Greater interest is being shown in light-actuated equipment and the operating principle of the new Venner light-sensitive switch is the reaction between hydrogen and chlorine gas. The gases combine in light at a rate depending on the light intensity. A small glass bulb with two electrodes sealed into it is partly filled with a solution of calcium chloride and hydrochloric acid. Electrolysis takes place and hydrogen and chlorine gases are produced. If the bulb is in darkness the two gases do not combine and a gas pressure is produced. One side of the bulb consists of a thin diaphragm which bends slightly with increasing gas pressure. The bending motion moves a mercury column which closes the circuit to be controlled.

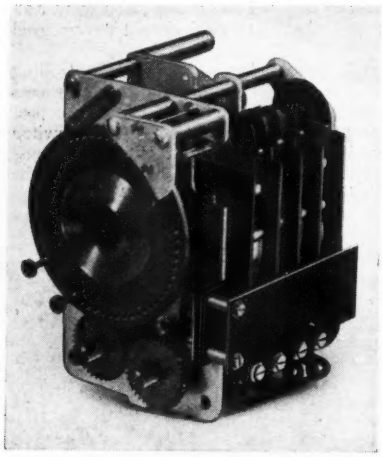
Radiovisor Parent, Ltd., say that impetus was given early last year to light-

actuated control of lighting by the Court of Appeal's decision that it is a continuing obligation on the part of local authorities to maintain the illumination of bollards during hours of darkness. The company has produced a control unit that ensures illumination of bollards according to daylight conditions, but which is so designed that failure of any component of the unit circuit causes the lighting to be switched on and to remain on until the fault is rectified. The company also report that light-actuated control of indoor lighting is increasing and points to the importance of light-actuated control of lighting in factories in view of the recommended standards for factory lighting in the Home Office Committee's report.

Timing devices in the second class referred to are almost exclusively used in connection with industrial processes. An Everett, Edgcumbe production has been extensively used in connection with the defrosting of cold storage plant, by stopping the pump motor at a given hour in the day and, after an interval, starting up the fan motor. The latter is automatically shut down after a given time and, at the expiration of a further interval, the pump motor is restarted and the contactor remains out of operation until the next defrosting period, when the timer causes the cycle to be repeated. Each of these times is separately adjustable.



C. & H. synchronous motor for time-keeping devices



Londex synchronous motor-driven contact maker

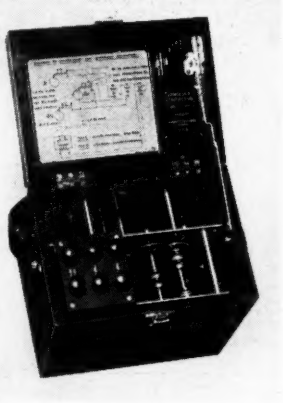
A new Sauter timer which is marketed in this country by Nathan & Allen, Ltd., is contained in a bakelite case, none of the sides of which exceeds 3¼ in.

The apparatus can be supplied either for flush mounting in a panel or for wall mounting. A considerable variety of timing ranges is obtainable, the smallest supplied being for a maximum of 60 seconds. The timer is set by hand by turning the knob until its arrow is opposite the desired time on the scale. Thereby the electric contact is closed and the timing cycle started. The clock movement is of a special design.

A Londex contact-maker consists of a synchronous motor-driven timing disc with 60 holes for switching pegs. By means of different sets of gear wheels the disc makes from one revolution in 30 seconds up to one revolution in 40 minutes. Four sets of 10-A contacts are fitted for any required sequence.

The latest development in "process" timing equipment is the Venner A.R.P. switch which has been designed specially for operating and controlling air raid warning signals. The switch is put into operation by pressing two plainly marked and coloured push-buttons—red for warning and green for clear. On pressing the warning button the switch operates the signal for five seconds "on" and three seconds "off" for the official warning period of two minutes. On pressing the "clear" buttons the signal is kept in continuous operation for two minutes and is then switched off.

A new time switch of unusual design is the "Electro-Boy" which is being sold in this country by Orel-Micro Electric. In appearance it is similar to an ordinary clock, being available as an alarm clock or as a mantel model. Setting of the switch is carried out by moving the bezel and up to seventy-two operations of the switch can be made in a twelve-hour period. All these can be preselected with ten-minute intervals.



Everett, Edgcumbe continuously running timer with complicated cycle

Meters for South Africa. From a Correspondent

Market considerations

DUE to the large amount of building in the Union of South Africa during recent years imports of electricity meters have shown a steady increase. While in 1931 they were valued at just over £28,000, last year they had risen to £62,000. The bulk of these imports of meters has come from the United Kingdom.

VALUE OF METERS IMPORTED.

	1937.	1936.
Total	£62,270	£50,898
From United Kingdom... ...	51,164	44,422
,, Canada	1,922	1,804
,, Germany	7,199	3,284
,, United States	1,665	166

Meters of less than 50 A enter free from the United Kingdom, but those from other countries pay a duty of 2s. 6d. each. United Kingdom meters above 100 A are admitted free of duty, but foreign meters have to pay a duty of 10s. each. British exports of meters to South Africa have undoubtedly been very much favoured by this tariff.

Meters are purchased almost entirely by the municipalities. The larger municipalities at least, such as Cape Town, Johannesburg and Durban, purchase them by calling for tenders and tenders issued by these cities call for quantities ranging as high as five thousand. Probably due to the large increase in the use of electrical appliances in South Africa of late years, practically all homes are wired for three-phase meters. Cape Town's specifications for three-phase meters, for instance, are usually for 15 A, 220-380 V, four-wire. This sells for about £3, delivered to the municipalities. Single-phase meters, of which much smaller quantities are used, would have to land in South Africa at a price which would enable them to be sold for about 18s. each. Meters must comply with British Standard Specifications.

Some details taken from a recent tender will supply an idea of the type acceptable in South Africa. This specifies that the meters must, in addition to possessing the more common requirements, have the worm of the main spindle made of a suitable alloy so that it does not corrode, that the pivot of the main spindle must be of highly polished and hardened steel and its bearing of an approved type. Both the pivot and the bearing must be easily detachable.

The terminal boxes of all meters must be capable of being sealed and must not be included in the meter case proper. All terminals must be clearly marked and separated from each other by insulating division walls. A diagram of all connections must be affixed to the inside of the terminal cover. The meters must be so adjusted that they will not register without current passing through the series winding with an increase in voltage on the shunt coil of 10 per cent. above normal. The accuracy of the meters should not be appreciably affected by voltage fluctuations not exceeding 10 per cent. above or below normal pressure.

Tenderers must guarantee a number of stated particulars, such as the percentage accuracy, the starting current per element in amperes, weight of moving element in grams, and other important particulars. The permanent magnets must be properly aged and should not be affected by the passage of a short circuit current through the meter. Tendering companies need to have their meters previously approved, and such approval can only be obtained through having had meters in the country on test.

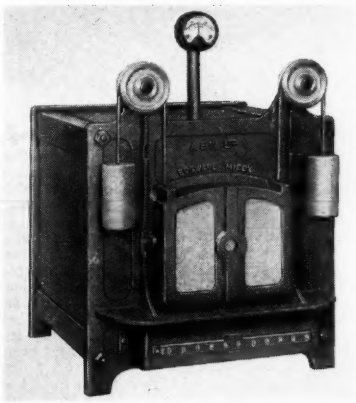
The Physical Society's Exhibition

Recent developments in instrument design

The annual display organised by the Physical Society has come to be looked upon almost as the "nursery" for new scientific instruments. At the twenty-ninth exhibition, which was held this week at the College of Science and Technology, South Kensington, the number of new electrical items was as large as ever. Particulars of them are given in the stand-by-stand review below. Besides the exhibition there were discourses on "The Cyclotron and its Applications" by Dr. J. D. Cockcroft, of the Royal Society Mond Laboratory, Cambridge, and "Geophysical Research in Polar Regions" by Mr. C. S. Wright, Director of Scientific Research, Admiralty

A.E.W., Ltd.

Among small electric furnaces for heating soldering irons and the heat treatment of small tools, type "D" (illus.) is the latest. It is completely self-contained and is fitted with a regulator and



A.E.W. type "D1" electric furnace

pyrometer for up to 1,000 deg. C., the size of chamber being 6 by 6 by 4in.

New products include slider-regulated resistances for up to 10 A, wound with oxidised nickel-copper or nickel-chrome wire on a ventilated porcelain former, with a protector bar carrying the indicator scale. Electrical pyrometers are made with scales of from 2.5 in. upward for up to 1,300 deg. C. Self-contained types are made for use in molten metals, salts, etc., while the thermocouples can be furnished either with refractory sheaths or special forms of protection.

Aldis Bros., Ltd.

Among projection equipment, one lantern demonstrates the Faraday effect when polarised light traverses a cylinder of glass round which current is flowing. In proportion to the strength of the current the plane of polarisation is rotated to a greater or less degree according to the magnitude of the magnetic field traversing the glass in its axial direction.

Automatic Coil Winder and Electrical Equipment Co., Ltd.

Now incorporated in the company's valve tester is a new universal panel, while a valve voltmeter added to the capacity meter indicates the voltage developed at resonance. A mains model of the all-wave oscillator (illus.) was on view for the first time, as was also a pre-production model of a low-resistance ohmmeter with two ranges from 0-20 and up to 500 ohms. On the lower range, half-scale deflection occurs at two ohms, thus allowing resistances of the order of one-tenth ohm to be easily measured with a deflection of one-tenth in. in length.

An inexpensive 50 cycle "AVO" test bridge is suitable for the direct measurement of resistances from below to above 10 megohms, and capacities from 10 $\mu\mu$F to above 10 μF. A further range provides for the measurement of inductance, while a "matching" range allows the measurement of resistance, capacity and inductance against external standards.

A coil-winding machine with a dual spindle adaptation enables one coil to be set up ready for winding while another coil is being wound on the adjacent winding head. An automatic cut-out stops the machine when a predetermined number of turns has been wound.

A high-resistance DC "Avominor" has six ranges from 2.5 to 1,000 V, all at 20,000 ohms per V, the consumption at full scale being 50 μA. This high sensitivity allows it to be used when the inclusion of a meter alters the circuit conditions, such as in the measurement of grid, screen and anode voltages, and also in television. Two current ranges are available of 50 and 250 μA. On the lower a deflection of approximately 1 mm. is produced by 1 μA, thus making the instrument suitable for indicating grid current. Resistances ranges of 5 and 50 megohms are provided, an external source of voltage being necessary.

Baird and Tatlock (London), Ltd.

A humidity conditioning oven has its temperature controlled electrically by a "Stabilec" thermo-regulator of the mercury type. A mercury-discharge lamp for ultra-violet light examination purposes is enclosed in an envelope of Wood's "black" glass to filter out most of the visible rays. It is similar in shape to an ordinary incandescent bulb and a special choke enables it to be controlled by an ordinary switch.

Bakelite, Ltd.

This display was in three main sections, dealing with laminated materials, synthetic resins for electrical insulation varnishes and the production of durable and corrosion-resistant finishes, and moulding materials of various grades. Gears machined from laminated material possess the merits of silence and resistance to chemical attack.

"Plybond," a new adhesive for bonding the layers of plywood, is supplied in rolls 50 in. wide by 5,000 ft. long. It has an exceptional water resistance and boards in which it is incorporated are claimed to be resistant to mould, insects and fungoid growths. Other products are: Paints and varnishes incorporating bakelite resins, spirit soluble varnishes for the insulation of electrical windings, lacquers and cements based on bakelite resins and mouldings, including housings for electrical and scientific instruments.

Baldwin Instrument Co., Ltd.

In the "Mufer" bridge the unknown capacity is balanced against one or other of two standard capacitances by means of a potentiometer of a special type which gives a logarithmic scale of resistance (and hence of capacity) ratios. By this means a large range is covered with a constant accuracy within ± 2 per cent.

An integrating radiation meter consists of a chamber in which the ionisation current is proportional to the radiation falling on it, and discharges the charge on the grid of a triode valve, which is immediately recharged. The number of

"Avo" all-wave oscillator (Automatic Coil Winder & Electrical Equipment Co., Ltd.)

discharges measured on a time base is a measure of the quantity and intensity of radiation. The particular apparatus shown was designed for the measurement of X-rays, but the instrument can be adapted for the measurement of a wide band of radiation covering ultra-violet light and infra-red rays.

Various types of miniature moving coil meters were shown and a DC potentiometer has been introduced for schools and colleges to take the place of the meter wire. An educational AC bridge consists of a number of components which can be arranged on a baseboard in various ways to form different bridge networks.

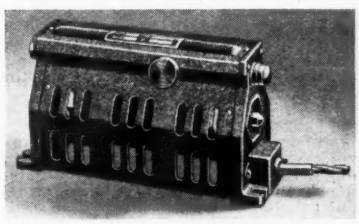
Bowen Instrument Co.

Automatic temperature controllers offered include photo-cell types for furnace work, and others for use with resistance elements, thermocouples, or radiation thermocouples.

British Electric Resistance Co., Ltd.

Protective pattern adjustable resistances (illus.) designed to comply with the new Home Office Regulations and suitable for use in laboratories, schools, factories, have covers and terminals so arranged that it is impossible for the operator to come into contact with any live part. Four standard terminal arrangements were shown, bakelite shrouded, two-pin plugs and cab-tyre and conduit entry.

Wire-wound hydrogen-filled "Pyrex" glass tubular fixed resistances have been



"Berco" protective pattern adjustable resistance

developed up to 500,000 ohms, capable of dissipating 500 W, the inner tube suspension being in the form of three stranded nickel flexible supports at each end, which results in improved mechanical strength. A range of switches has been designed with roller click action, for up to 200 A.

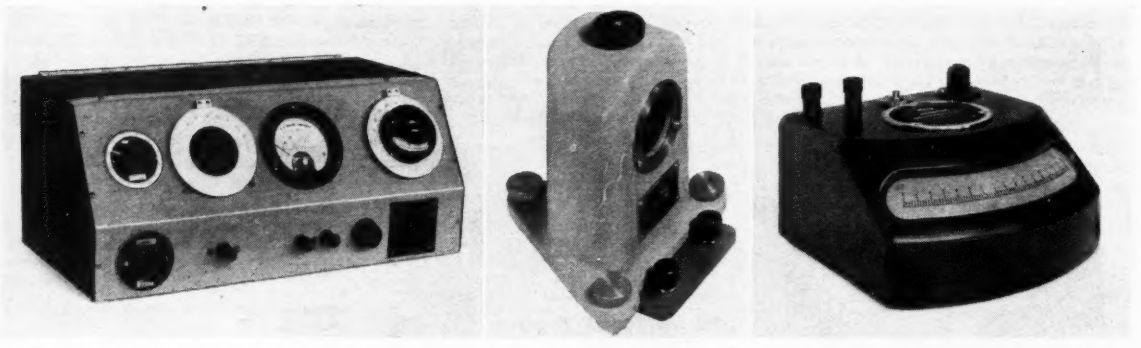
Among small-power transformers was an insulation test set comprising transformer, circuit breaker, voltmeter, potentiometer, etc., all enclosed in a metal case and arranged for wall mounting. Fine adjustment from zero to 2,500 V may be obtained, and provision is made for operation of a safety lock on the testing cage. Shrouded transformers are an addition to the standard range.

British Physical Laboratories

A bridge for ganging variable condensers under mass production conditions has a jig to which the condenser under test is connected. By rotating a knob, the condenser may be tested and aligned at six different preset angles. The indicating meter deflects in opposite directions for values higher or lower than the standard. A "magic-eye" indicator shows a cross when the condenser under test is making contact with the bridge. When disconnecting the condenser, no switch has be to actuated, as an electronic switch is incorporated.

A direct-reading capacity bridge for testing paper condensers under mass-production conditions by unskilled labour has a range from 0.01 to 10 μF, while a Q-meter for measuring the power factor of condensers at high frequency, by comparison with a variable condenser with a negligible power factor connected in series with a variable resistance, has five ranges and operates at 1,000 kc/s for capacities up to 1,600 $\mu\mu$F, and for values up to 3,000 $\mu\mu$F the test frequency is 500 kc/s.

A viscosimeter (Dr. Schneider's patents) for the chemical industry is self-recording and operates on the falling sphere method and covers a range from 500 to 25,000 centistokes. A conductivity bridge for electrometrical titration is especially suitable for opaque liquids. The principle involved in a meter for the measurement of the velocity of bodies, is the production of a voltage, the duration and amplitude of which is related projectile velocity.



British Physical Laboratories Q-meter, Tinsley portable galvanometer type "4,500-A" and a Cambridge spot galvanometer

British Thermostat Co., Ltd.

For use in conjunction with magnetic or motor-operated valves the "Teddington" automatic temperature controller for furnaces is available with movements suitable for any of the usual electrical heat-sensitive devices, such as resistance elements, thermocouples or radiation tubes. It has two chopper-bars, driven by a single motor, to operate a mercury-switch mounted on a balanced double-beam forming a parallelogram and having a single actuating plate. A humidistat has a strip of hygroscopic material of negligible temperature coefficient held under tension, its expansion or contraction operating the switching mechanism.

A "STAF" thermostatic expansion valve for automatically controlling the flow of liquid refrigerant, allowing the maximum amount which can be evaporated under the prevailing conditions to enter the evaporator, is controlled by a thermal phial in contact with the suction pipe from the evaporator. The thermal power element is a separate unit enclosed in a transparent bakelite moulding which provides thermal insulation and also permits the adjustment scale to be read.

A dry-contact relay for use where mechanical vibration or rolling preclude the use of a mercury-tube switch has fixed contacts in a horizontal glass tube, and bridged, when the electro-magnet is energised, by a steel rod which normally rests on the bottom of the glass tube. A permanent magnet retains the rod in the lower position when the electro-magnet is de-energised.

Cambridge Instrument Co., Ltd.

This year the company devoted its stand entirely to galvanometers. Several were shown for the first time, such as a compact form of Einthoven string galvanometer (illus.) incorporating a permanent magnet made of special alloy. The air gap has been reduced so that the field strength is greatly increased, with a corresponding increase in the sensitivity. A double pivoted coil type similar to the "T Unipivot," mounted in a moulded assembly, forms a convenient portable sub-standard.

Recording galvanometers include the recently designed model "A" metal-cased instrument, which can be fitted with either two, three or four threads of different colours, a clock-driven rocking mechanism bringing the threads in turn under the pointer and also connecting the corresponding circuits. The pointer is automatically depressed at frequent intervals to form the record and the particular circuit connected up at any time is clearly shown on a dial which is coloured in accordance with the record. Another recorder gives up to six continuous records in distinct colours on a chart 5 in. wide at a speed of ½ in. per hour, so that the record for the past 18 hours can be examined at any time without opening the instrument.

Among the AC instruments is a new spot vibration pattern, which comprises a pot galvanometer mounted together with a self-contained lamp, supply transformer and a radial scale, in a compact moulded case, and fitted with a mechanical tuning device for covering a range of 5 cycles above or below the nominal frequency. A new milliammeter "L Unipivot" galvanometer with thermal scale is used in conjunction with ranged vacuo-junctions which are plugged into a socket in the top-board of the instrument. A comprehensive series specifically designed to meet the requirements of the Electricity Commissioners includes special sub-standard dynamometers which are shown working in conjunction with auxiliary apparatus of the type normally required for meter testing.

R. M. Catterson-Smith

A laboratory rotary calciner fitted with a silica muffle to contain the charge is capable of attaining a maximum temperature of 1,200 deg. C. The reduction gear fitted gives a final speed of one r.p.m., but provision has been made to vary this speed slightly. Temperature control by voltage variation at the furnace terminals is brought about by employing an associated auto-transformer. A novel feature is the one-piece heater with ends brought out to concentric slip rings for single-phase working.

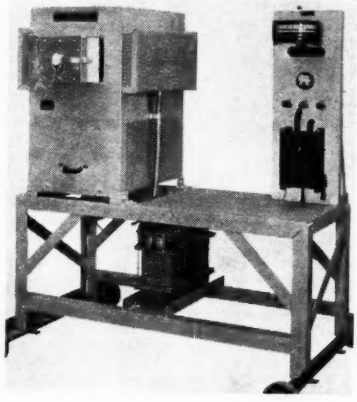
An "SSRD4" furnace (illus.) having chamber dimensions of 10 in. wide by 6 in. high by 16 in. deep and capable of attaining an upper temperature of 1,400 deg. C., has been supplied to the Engineering Department of the North Staffordshire Technical College. Mounted as a compact unit, complete with switchboard, indicating pyrometer outfit, regulating resistance and tapped auto-transformer.

A pump oven, shown by the courtesy of British Electric Lamps, Ltd., consists of two half heaters designed to fit round a certain type of electric lamp while it is being exhausted. The lower half can be dropped and the top half swung back and 50 V supply has been chosen for safety from the operator's viewpoint. In a rapid heating furnace supplied to the Department of Fuel Research of the Imperial College of Science and Technology, London, a temperature of about 1,000 deg. C. can be attained in about 3 minutes from cold.

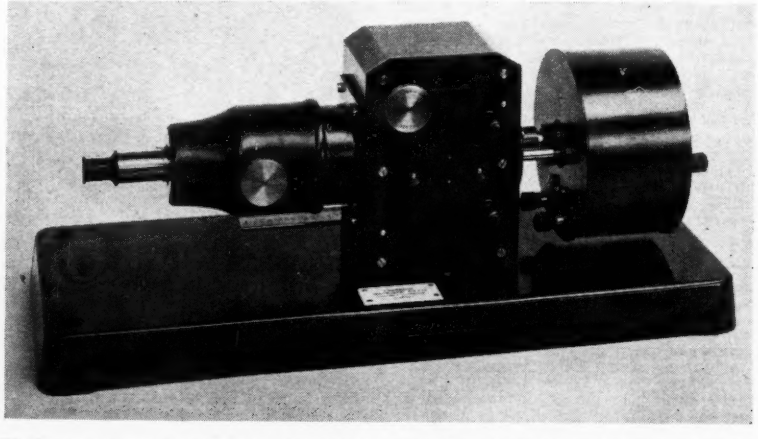
A. C. Cossor, Ltd.

A portable single/double beam oscilloscope (illus. p. 11) with a 4½-in. high vacuum cathode-ray tube and having a high-gain/wide-band amplifier and hard valve time-base is now available at a low cost. It has a large field of operation, since the time-base has a frequency range of from 2 to 250,000 cycles and can be used to examine wave-forms from a frequency of about 4 cycles up to about 4 Mc. A bridge circuit tester for use with an oscilloscope enables speedy tests of an accuracy better than 1 per cent. to be applied to condensers, inductances and resistances over a wide range of values.

For pressure recording it is desirable to provide a sensibly linear X-axis deflection, the repetition frequency and relaxation of which can be controlled mechanically. A small sweep unit includes a selection of resistances and condensers controlled by two multipoint switches and excited through the medium of a stabiliser chain between 500 and 1,000 V. The condenser may be discharged by a mechanical contact breaker driven from any engine or rotary source connected with the measurements being made, and a screened output socket is used to enable the saw-tooth voltage developed to be introduced into a suitable amplifier.

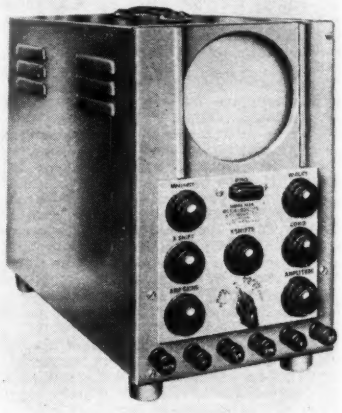


Catterson-Smith furnace for technical college



Einthoven string galvanometer, permanent magnet type (Cambridge Instrument Co.)

A balanced amplified hard valve time-base provides the large deflection voltages necessary for modern high voltage cathode-ray tubes, and replaces the older type "3342" time base. The frequency range is continuous from a few cycles to above 0.2 Mc, and provision



Cossor model "3339" oscilloscope

is made for synchronising the sweep to any desired signal.

A cardiograph with power supply unit employs an electrostatically deflected, gas-focused cathode-ray tube as the recording medium and the patient voltage is applied by way of a resistance capacity coupled amplifier of long time-constant and high gain. A variable speed electrical time axis enables the user to view the electro-cardiogram on the long after-glow screen. A spring-driven moving film camera is built into the unit.

Crompton Parkinson, Ltd.

Besides educational pattern instruments, were shown ammeters and voltmeters with dials illuminated through a slot in their base, the lamp being outside the meter case. Dynamometer wattmeters of the moving iron and moving coil classes, as well as slide-wire potentiometers, have been produced to comply with meter testing requirements.

Darwins, Ltd.

For automatic train control on the Hudd system the company's "Alnico" permanent magnets on the permanent way actuate a cobalt steel magnet armature in a receiver unit on the locomotive. The magnet controls a vacuum valve, which in turn actuates a horn warning the driver and also gives automatic and progressive braking.

A new type of hand signalling generator recently adopted by the Post Office employs an "Alnico" magnet with greater efficiency, lighter weight and better output than the earlier types, while a new moving coil switchboard instrument employing a magnet system consisting of an "Alnico" block with stainless iron poles gives higher torque, uniform and consistent scale shape and improved damping. "Electron" lenses are permanent magnets suitable for magnetic focusing in cathode-ray tubes.

Ebonestos Insulators, Ltd.

A comprehensive display of mouldings in "Ebonestos" compositions, bakelite, "Diakon," cellulose acetate and other synthetic materials mainly comprised component parts manufactured for use as parts of electrical apparatus, instruments and kindred applications.

Edison Swan Co., Ltd.

A special physiological amplifier designed by Mr. W. Grey Walter, who has been engaged on neurological research for some years, consists of three identical high gain amplifiers, each connected to a separate cathode-ray tube, enabling three traces to be observed simultaneously. The tubes are mounted vertically in the centre of the rack, and are viewed through small square apertures, while below the tube compartment are a slow sweep time-base and high voltage power pack. Filter circuits minimise "mush" and the gain can be varied continuously to a maximum of 5 to 10^6. The apparatus is being installed in the Nuffield Research Institute at Oxford.

W. Edwards & Co.

High vacuum diffusion pumps operating with organic pump fluids are now available which effect self-purification of the pumping fluid during operation by a patented fractionation process. Several new organic fluids of very low vapour pressure have been synthesised. Kaye mercury diffusion pumps have been completely redesigned, and have speeds from 2½ to 180 litres per sec. A new Philips vacuum gauge gives continuous indication of pressures between 1.5×10^{-3} mm. and 1×10^{-5} mm. of mercury.

Elliott Bros. (London), Ltd.

A Shotter-Elliott peak comparator (illus. p. 13) enables the percentage change in peak factor of the voltage wave form of the mains supply to be measured directly. It therefore enables the requirement under the Meters Act, that AC circuit control apparatus shall not affect the peak factor by more than three per cent., to be checked. The apparatus is made up into three units: the first deals with from 200 to 250 V, the second enables outputs down to 8 V to be tested, while the third enables the peak factor of the output current wave to be compared with the peak factor of the input applied voltage. The apparatus consists essentially of a neon detector with a small AC milliammeter, together with adjustable rheostats and transformers.

A surge-proof leakage recording ammeter complies with the revised requirements of the Electricity Supply Regulations, 1934, on "Earthing of Low Voltage Networks" Regulation 4 (D), and consists of a special shunt capable of carrying 250 A continuously and a special high speed relay, the operating coil of which is connected in series with the main circuit, operating when a short occurs, thereby inserting resistance in the moving-coil circuit of the recorder and increasing its range to 250 A.

The Elliott-Shotter water-level equipment with remote automatic control and alarms, over two wires only, provides automatic starting of the pumping set at a pre-determined low level, and automatic stopping at a pre-determined high level. Control is effected by a high-torque moving-coil instrument fitted with adjustable high- and low-level contacts, which is operated by the distant water-level transmitter.

A meter developed for the Food Investigation Board for indicating the carbon dioxide and oxygen content of the atmosphere in cold stores depends upon the fact that the thermal conductivity of carbon dioxide differs appreciably from that of the other gases normally present.

Ellison Insulators, Ltd.

"Tufnol" in sheet, tube, and rod forms for mechanical and electrical purposes included an electrical slipring assembly, a centrifugal switch, and a push switch for a large electric drill. There is also a 2-in.-diameter ball-strain insulator for a working load of 1 ton.

An inspection torch (illus.) used in oil and petrol containers eliminates the risk, that would be present if metal torches were used, of sparks being struck from the sides of the tanks. Illustrating the resistance of "Tufnol" to chemicals were a nozzle used in filling batteries with acid, and a plating barrel. Various small parts demonstrating the ease with which "Tufnol" can be machined and its value where strength and hard-wearing qualities are required were nuts and bolts, small gear wheels, pulleys, &c.

A "Tufnol" torch (Ellison Insulations)

Erie Resistor, Ltd.

Resistor elements protected by a preformed, uniform ceramic wall that will withstand 3,000 V, AC, are made in ½- and 1-W sizes in values from a few ohms to several megohms. The latest development is the method of sealing the wire ends of the resistance unit by an injection operation. This totally protects the resistor from atmospheric variations and increases the mechanical strength.

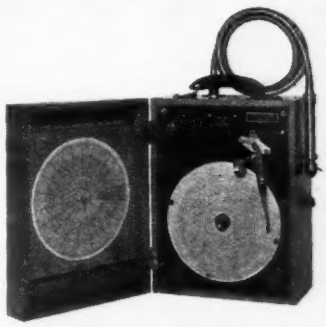
"Ceramicon" low-loss condensers have a ceramic dielectric with coated plates of pure silver fired on at very high temperatures. For capacities of 5 $\mu\mu$F, or less, the dielectric is one of the "Steatite" groups of ceramics, and for capacities about 5$\mu\mu$F a titanium dioxide is used. Erie silver mica condensers are for use in tuned oscillator circuits which must not change regardless of operating conditions. The type "F" unit has a positive temperature coefficient of only 0.000025 per deg. C and is very small in overall dimensions.

"Neron Urdox" and iron resistances for radio apparatus protect components which have different heating-up times, due to the different ratios of their resistance in the cold state to that in the hot working state, and also to their very different thermal capacities. "Urdox" equalising resistances are employed either alone in a bulb or in series with an iron filament inside the bulb.

Everett Edgcumbe & Co., Ltd.

Self-protected leakage indicators have a saturable nickel-iron cored transformer, through the central aperture of which passes either a single conductor, for connection in the earth circuit of a three-phase generator or transformer, or, alternatively, the three or four conductors of an individual feeder. The indicator, although scaled up to 10 A, is divided so that small fractions of an ampère can be measured, while the equipment is undamaged by the most severe fault.

The fault grapher has recently been



Colliery cage speed recorder (Everett Edgcumbe & Co.)

modified so as to record the earth fault current, whether of the system as a whole or of an individual section or feeder. A recent requirement for such a recorder was that 20,000 A must be recorded, but that as little as 100 A should also be legible on the chart. A curved glass front is now fitted to all "Inkwell" graphers.

A universal testing set for garage use comprises a multi-range ammeter, a voltmeter, and an ohmmeter, together with a high-voltage calibrated spark gap. A combined battery terminal with a 500-A shunt enables measurements of the starter current to be made under actual working conditions without any disturbance of the car wiring.

A new AC/DC model of the electrician's "All-Purpose" tester has ranges appealing particularly to testing engineers and electricians generally. All current, voltage, and resistance measurements are made on direct-reading scales, with twenty-five ranges in the standard set. A colliery winding cage speed recorder (illus.) has also been developed.

Evershed and Vignoles, Ltd.

The "Bridge-Meg" cable set has

been used for many years for making Varley loop tests, and a special instrument is now available which, with the addition of an extra terminal, together with an external resistance and a high-sensitivity galvanometer, may be used for making Murray loop tests.

The "Megger" paint tester permits the rapid determination of the comparative values of different kinds of paint, varnish, and other coating materials, such as wax, enamel, linseed oil, &c. These may be considered as membranes, which, although initially impermeable, become permeable as the material deteriorates, and by measuring the rate of decay of the osmotic or electrosmotic resistivity of the paint membrane, the comparative life of different coatings can be compared in the course of a few hours. The apparatus consists of a cell or number of cells connected to an indicating or graphic recording ohmmeter. The makers have been using this apparatus for some time in connection with the testing of insulating varnishes, and have obtained valuable information regarding the most efficient temperatures and times of stoving. Information has also been obtained on the relative values of insulating cloth.

The "Meg" salinity tester for determining the salinity of cured meat without spoiling it measures the electrical resistance of the meat at different depths, the relationship between the ohmic resistance and the salt content having been determined from a large number of tests carried out by the British Food Manufacturers' Research Association.

Ferranti, Ltd.

The standard dual range light tester having two scales of 0-25 and 0-250 ft.-candles is now supplemented by a three-range instrument with a scale length of approximately 4 in., permitting readings of 0-1, 0-10 and 0-100 ft.-candles to be obtained.

The live line insulator tester for testing insulators whilst they are connected to overhead high-voltage lines in service has been improved in a number of respects, and one of two equipments developed for pressure testing low- and medium-voltage cables at 1,500-V DC consists of a 2-valve rectifier circuit with the positive output terminal earthed. The valves are connected on the voltage doubler principle, smoothing condensers are included, and a regulator of the moving-coil type is incorporated. Instead of valves metal rectifiers can be supplied, when the output is reduced to 20 instead of 50 mA.

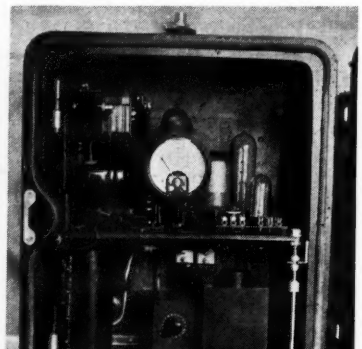
A new portable sub-standard meter designed for testing under the Meters Act is available with single ranges of 1, 5, 10, 20 and 50 A, or as a 5-A unit for use with multi-ratio precision current transformers. It can also be supplied with up to three voltage ranges.

A small transformer for operating bells in explosive atmospheres has been approved at the Buxton testing station.

The latest developments in aircraft instruments include an improved gyroscopically controlled bank and turn indicator (illus. above), and fuel and oil pressure gauges of the transmitting type in which the liquid under pressure is kept remote from the indicator. There are also engine and airspeed indicators and engine cylinder thermometers, besides a wide range of "miniature" electrical instruments, relays and synchronous motors.

Foster Instrument Co., Ltd.

The Foster-Birlec interlocked automatic control for furnaces is an addition to the "Flexipush" indicating pyrometer for recording one or more "key" temperatures in the furnace. A safeguarding device is also introduced whereby an alarm signal is operated if a failure occurs, due, for instance, to a contactor sticking.



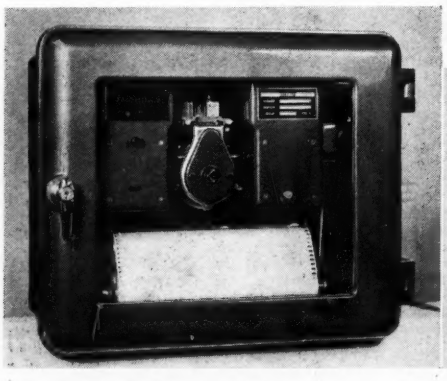
Foster amplifier unit for high-speed photo-electric recording pyrometer in water-cooled case

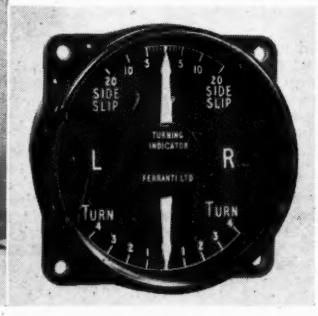
A photo-electric high-speed recording pyrometer recently has been developed to extend the value of the temperature information it provides. A photo-electric cell is exposed to the radiation emitted by the hot body, and the resulting electrical effect is converted and amplified to actuate a direct writing recorder. A new safety device has been added for protection from overheating by enclosure in a water-cooled housing.

To guard against errors, the emergent ends of the thermo-couples and compensating leads are now made non-interchangeable by a novel system of shapes and sizes. Introscopes of new patterns enable internal inspection to be carried out with ease and accuracy.

A. Gallenkamp & Co., Ltd.

A cabinet for testing materials in controlled humidity has heating elements in the floor below a wire mesh shelf. Thermostats in the roof provide a constantly uniform temperature of ±0.5° F. The humidity controller operates a relay energised from the mains, which switches on and off a moisture generating unit fitted in the wall of the cabinet. This comprises a copper tube fed with water and arranged to maintain a constant level, fitted with a blade type electric immersion heater which vaporises the water. The vapour is dispersed by a fan which is driven by an electric motor outside the cabinet.





Geo. Kent "Multelec" pH recorder and controller, and the Ferranti bank and turn indicator

Gambrell Bros. & Co., Ltd.

Meter-testing components include potentiometers with an accuracy of one part in 10,000; voltage dividers for up to 800 V that do not suffer in accuracy by leakage across the insulation; and a range of standard shunts for up to 100 A. Other products are pH meters, precision variable air condensers, portable testing sets, Wheatstone bridges and new testing keys which maintain high insulation resistance.

Griffin & Tatlock, Ltd.

A new laboratory press (illus.) for mounting specimens in bakelite for metallographic examination is hand-operated hydraulically. The base incorporates a pressure gauge and release knob, a voltmeter and rheostat control for the heating elements, which are applied in a novel way. An electrically heated split aluminium block is clamped scissors-like round the mould, and a similar solid block controls the rate of cooling.

The latest laboratory and industrial pH meters are free from errors due to electrostatic effects. A shielded glass electrode and sealed calomel electrode are mounted together on a common holder for simultaneous insertion into the solution to be tested. Fall of potential along a precision slide-wire potentiometer is balanced against the potential due to the glass electrode, the out-of-balance being amplified by a thermionic valve circuit so that ageing of the valves and changes of battery voltage do not affect accuracy. Balance is indicated by a mV meter and pH value by the potentiometer dial.

For educational work there is the "Microid" cathode-ray oscilloscope in a hooded case so that it can be used in full daylight. A beat frequency oscillator, in a separate carrying case, is adjustable over a range of 0-16,000 cycles and the trace sensitivity is 25 mm. per V.

Griffin & Tatlock metallurgical mounting press with electrically heated split aluminium blocks

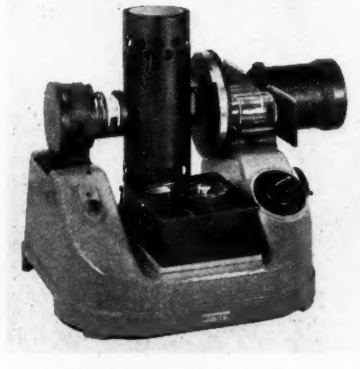
Charles Hearson & Co., Ltd.

Apart from microscopes, several forms of thermostats are offered for hot-room regulation with the aid of relays; also an electrically heated temperature controlled oven.

Adam Hilger, Ltd.

A large quartz and glass spectrograph with fully automatic adjustments and similar instruments with a quartz train only are offered for the routine analysis of metals, including complex alloy steels, putting at the user's disposal the greater dispersion of a glass system in the visible part of the spectrum. Both systems are controlled by a single handle and are interchangeable by rotating another one. Another instrument, the Hilger Barfit medium quartz spectrograph, has a completely flat plate.

Manufacturers of lamps and cathode-ray tubes will be interested in a new glass thickness viewer, while an interest-



A "Spekker" absorptiometer (Adam Hilger)

ing application of the barrier-layer type of photo-cell is made in the Spekker absorptiometer (illus.) for chemical and biochemical analysis when the light absorption of a coloured solution is the measure of the concentration of a constituent. The colours of glasses used in traffic signalling systems, aircraft landing lights and similar apparatus can be specified with the aid of a Donaldson trichromatic colorimeter.

Henry Hughes & Sons, Ltd.

Marine echo sounding gear was shown, together with a new type of aero compass of the electron pattern in which the earth's magnetic field deviates a cathode-ray, which is free from inertia effects, and can be controlled to almost any degree of accuracy.

I.A.C., Ltd.

The uses of mercury switches and relays combined therewith are progressing steadily, even for fairly heavy currents. Experiments are now in progress regarding the production of non-tilting types of much greater capacity than hitherto. Switches are now standardised for up to 1,500 V, and special precautions can be taken to enable them to be applied to high-frequency work. In the case of relays the ratio of control to controlled energy can in many cases be made as low as one in 1,500.

Igranic Electric Co., Ltd.

Four-speed controllers for pole-changing squirrel-cage motors, used principally for machine tool control, are in many cases designed for building-in pockets in machines, while others are for surface mounting. For "plug" stopping these motors quickly, additional contacts connect the low speed-winding on to the supply with phases reversed, either by moving the speed selection lever into an extra "gate" or by means of a second lever provided with "on," "off" and "brake" positions.

For the automatic plugging of AC motors, switches run on ball-bearings are mechanically coupled to the motor shaft, to "make" when the motor is running and to break contact when the speed reaches zero. They are used in conjunction with an automatic starter in the usual way, and there are two types; an eddy current pattern which operates its contacts without mechanical friction, and another with contacts operated by friction discs.

Type "1009" starters (illus. below) for squirrel-cage motors up to 2 HP (direct-on-the-line) have a triple-pole, air-break contactor and three thermal overloads in a dustproof case of cast-iron with push-buttons. An auto-temperature controlled soldering iron for operating from a low-voltage transformer or battery eliminates danger of shock to the user. An optional feature is a lamp throwing light on the tip.

A long time delay relay for industrial applications requiring a time lag up to 4 or 5 min. has a series of pneumatic bellows operated by a solenoid. A range of multi-way pushbutton control stations includes pendant types, and low-voltage lighting transformer units rated for 48 W and 100 W are of the self-isolating pattern with two primary and two secondary fuses and a double-pole primary switch.

George Kent, Ltd.

One new item consists of two "Multelec" instruments (illus. page 12), one recording continuously the varying pH of raw effluent and the other arranged as an automatic controller regulating the dosage of an alkaline re-agent and recording on a chart the result of the control in the form of a steady pH line.

Also shown for the first time was a portable pH measuring set, which is entirely self-contained in an aluminium case. The circuit incorporates a two-valve Wheatstone bridge network and an accurate potentiometer. The accuracy of measurement with this instrument is plus or minus 0.05, or ±2 mV.

Kohl's Scientific Instruments, Ltd.

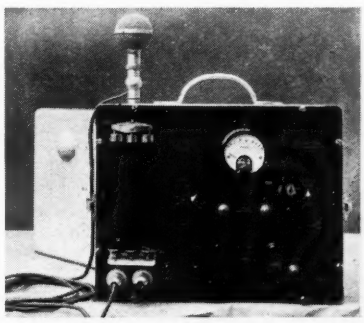
Portable X-ray apparatus in two carrying cases provides 5 or 10 mA at 63 kV peak. Special X-ray tubes can be constructed to users' requirements, and educational sets of electrical apparatus are available which can be put together for experimental demonstrations.

Leland Instruments, Ltd.

A large selection of radio and electrical testing equipment for both research and service uses included a small portable crystal controlled frequency calibrator, radio noise and field strength meters, electronic voltmeters, signal generators and cathode-ray oscillographs in portable cases.

Londex, Ltd.

A new regulator (illus.) due to Dr. W. L. Stern consists of two small synchronous movements which actuate a differential gear. As soon as the synchronous running of one of the motors is disturbed by the deflection of the pointer of an indicating ammeter or voltmeter, the planet wheel of the differential gear rotates bodily in one direction or the other, and this movement is utilised to operate control devices of any type. It works without any relay, needs no auxiliary contacts or time de-

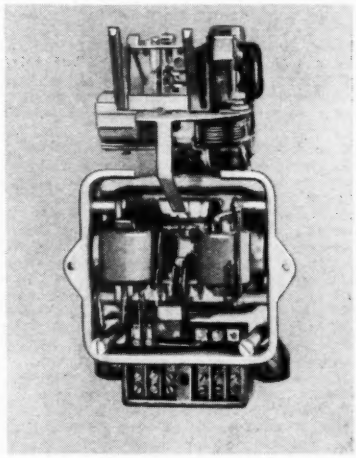


Marconi-Ekco direct reading noise meter

lay relays, and, in spite of the purely mechanical operation, is sensitive and can be used for up to 0.5 per cent. regulation of voltage.

Used especially for high pressures (300 atmospheres), an automatic liquid level control consists of a small float of magnetic material which passes through a coil, the latter fitted to the outside of a tube. As soon as the float passes through the coil, the impedance changes and a relay controls the pump switch.

An adjustable contact maker with a



Londex electrical regulator

small synchronous motor driving over an adjustable friction gear, actuating a contact device at recurring intervals, is especially suitable for process timing, while a quick-striking relay, which serves especially for simplifying complicated relay schemes, consists of a solenoid, plunger, and mercury switch arranged in such a way that the mercury makes contact only once, for a fractional part of a second, if the coil is energised; de-energisation does not produce a new contact.

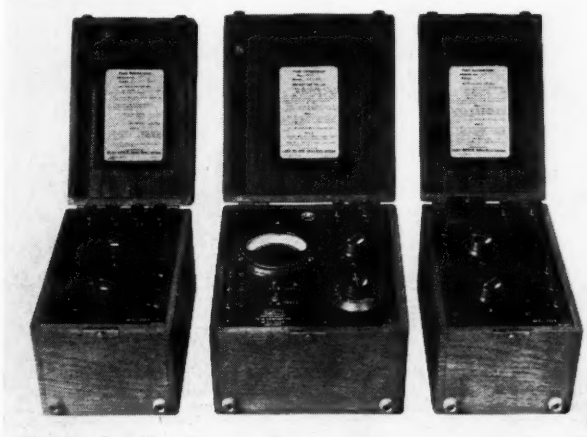
London Instrument Co., Ltd.

One new item is a method of mounting motors on laboratory apparatus and machines so that they can be quickly removed and put on again. One motor may thus be employed for driving several pieces of apparatus in turn.

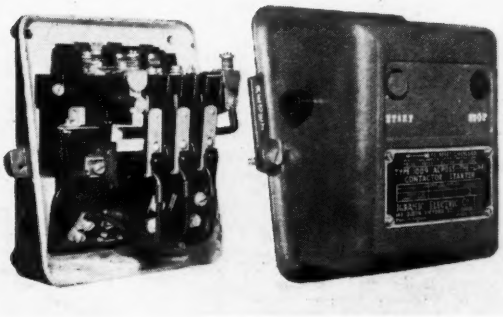
Marconi-Ekco Instruments, Ltd.

A novel mercury switch has small movement of the iron core, and switching takes place within a special transparent ceramic switching chamber. A portable direct-reading objective noise meter (illus.), calibrated in phons, is provided with weighting networks approximating to the 40- and 70-phon contours. A level frequency characteristic can also be selected, and care has been taken to ensure an accurate assessment of intermittent and impulsive sounds.

A completely self-contained audiograph for the automatic plotting of response curves of loud-speakers, amplifiers, filters, and all types of audio-frequency equipment has a motor-driven beat frequency oscillator which supplies the test tone, and the output from a microphone or from the equipment under test operates a self-adjusting attenuator to maintain a constant level. The attenuator setting and the frequency form the ordinates and abscissæ, great repetitive accuracy being obtained. The audiograph is manufactured under



Left: The Elliott-Shotter peak comparator enables the percentage change in peak factor of the voltage wave form of the mains supply to be measured directly. Below: The Igranic type "1009" across-the-line starter with three thermal overloads



licence from the Tobe Deutschmann Corporation.

In a wave analyser for the separate measurement of the components of a complex audio-frequency wave or of the modulation components of a radio-frequency signal, separation of the component to be measured is made by modulating a local oscillator with the test signal in a balanced ring bridge, which suppresses both the carrier and modulating signals, leaving the sidebands.

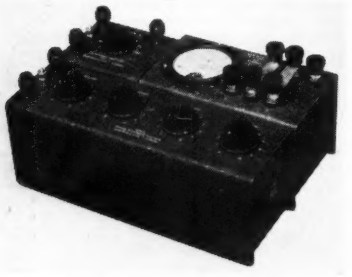
Mercury Switch Manufacturing Co., Ltd.

Among new products there is a mercury switch that introduces a delay feature at both make and break of circuit, both poles being dead in the "off" position. There is also a change-over switch giving a delay feature when changing over from one circuit to another, such circuits overlapping or otherwise, as specified.

A range of power type fused-in-porcelain-liner mercury switches is fitted with top entry electrodes, while a switch intended for 100 A and over is so constructed as to give positive snap action and avoid mercury dribble (patented). A new range of fused-in-porcelain-liner switches with extra short break function with a small tilting angle from "on" position to "off" position, but allow the switch to be over-tilted without risk of "rebreak."

Muirhead & Co., Ltd.

Cheap resistance units with the "Munit" features have been introduced



Muirhead "Munit" assembly

specially for educational work, adjusted to 1 per cent., but nevertheless wound non-reactively in the same manner as more accurate units. "Munit" construction (illus.) means mounted in metal boxes, for mechanical strength and good electrical screening. The length and breadth are multiples of half an inch, so that boxes of all sizes may be easily bolted together in either direction, or to a base board or panel. This is particularly useful in semi-permanent installations, or for temporary installations in the field, and is comparatively cheap.

In the type "6" audio-frequency oscillator the frequency is determined by a network of resistance and capacity which gives zero phase shift between input and output at one frequency only. With variable air condensers of reasonable values a frequency range of 10 : 1 is obtained, changed by altering the resistance values in the network by a switch.

The Muirhead - Belin chronograph checks frequency standards against a clock or against impulses received from another frequency standard.

Mullard Wireless Service Co., Ltd.

In a detonation meter designed at the Royal Aircraft Establishment for internal combustion engines, a pick-up is inserted in the cylinder. An unorthodox indicating circuit is employed, combining a gas triode valve and electron beam tube.

A pressure indicator, said to involve a new principle of design, has as a pick-up a balanced capacity bridge in which changes modulate a high-frequency oscillator circuit. The output of the latter is amplified and rectified, and the low-frequency component is applied to the vertical plates of a cathode-ray tube.

Multitone Electric Co., Ltd.

With the assistance of a microphone with power-radiating amplifier and three-valve receiver, deaf-aid installations are available for group hearing by induction in lecture halls and theatres without having to plug-in to any fixed point. Test instruments are made for determining the requirements of individual cases, together with valve-actuated aids with microphones of the carbon, crystal, or magnetic kinds, and what are claimed to be unusual circuit arrangements.

Nalder Bros. & Thompson, Ltd.

A deflectional frequency meter recently marketed is claimed to be free from self-heating error and the readings are unaffected by variations of ambient temperature or wave form, while a change of ±15 per cent. in voltage causes no change in the frequency indication. The instrument is manufactured in sizes from 4 in. to 20 in. diameter dial and in two forms; one gives an angular deflection of 150 degrees and the other 220 degrees. The 8-in. diam. size has a range 48-50-52 cycles, the scale extending over 150 deg.

A new indicating flameproof ammeter of the controller pattern for use in mines has been approved by H.M. Mines Department. Portable graphic recorders in light metal cases have an improved window, ensuring clear indication of 7 hours' record, and also a scale for instantaneous reading.

Flat scale edgewise instruments, by avoiding the use of curved scales, may be read directly from the front, and the measuring element can be arranged for indicating ampères, volts, watts, kVA and power factor.

Negretti & Zambra, Ltd.

A time cycle recorder for controlling an entire process in agreement with a predetermined temperature/time or pressure/time curve, for example, in rubber vulcanising, utilises a mercury-in-steel thermometer and balanced pilot valve without interposing relays. It is governed by the setting mechanism positioned by a process cam, which is transparent and of the same proportions as the instrument chart which facilitates defining its contour.

A simple three-step alarm or control device uses a mercury-in-steel system with a simple link mechanism operating three mercury-in-glass switches in a presetting sequence which is adjustable within certain limits. Mains voltage and up to 5 A can be carried by each switch, while an indicating scale and pointer show the correct temperature at all times with a single setting pointer for control variation.

A new design of millivoltmeter movement in which a high internal resistance with damping is obtained without employing small dimension parts and minute clearances is embodied in a really robust indicating pyrometer for industrial conditions. It has a 10-in. scale, with an anti-parallax mirror, the pointer being of the knife-edge type. Sensitivity is 20 ohms per mV, and automatic cold-end correction is standard.

A rotary selector for multipoint pyrometer or resistance thermometer indicators employs a new arrangement of mercury switches with 90 deg. angle of tilt, thus making it suitable for marine use. Each switch can accommodate up to a maximum of fourteen points and embodies an illuminated position plate. An indicating multipoint potentiometric pyrometer incorporates selector switchgear so that a reading can be obtained from any one of a number of points.

L. Oertling, Ltd.

Among prismatic balances of various sorts is a magnetic assay outfit with a sensitivity of 0.01 mg. per division. Another type with a sensitivity of 0.001 mg. per half division on an illuminated scale has its beam and upper parts protected in such a way as to neutralise the effects of eddy currents.

Philips Lamps, Ltd.

The Philips-Suschyzki method of testing wire ropes operates on the magneto-inductive principle, alterations in the magnetic field caused by faults in the specimens being detected by means of search coils which pick up and measure the electro-magnetic disturbances. The rope is passed through the electro-magnet and the coil is sub-divided into three parts so that the induced currents are recorded by three galvanometers. In this way the instrument gives not only an indication of the breakage but also shows its approximate position. A camera attachment enables the existence and position of a fault to be recorded photographically.

For determining the thickness of the walls of pressure vessels by means of X-rays a new counting tube has been developed which has led to the introduction of a simple measuring device, the sensitivity of which is considerably greater than that of the ionisation chambers usually employed, while for routine inspection the time required to adjust the apparatus is only about one-tenth of a second. Self-contained equipment for X-ray analysis by the Debye-Scherrer rotating single crystal, or Seemann-Bohlin methods enables all types of cameras to be used.

Among rectifier valves is a water-cooled mercury cathode type with an efficiency of over 95 per cent. at full load. "Starting" tubes might almost be called inverse barretters, in so far as they work in exactly the opposite way, their electrical conductivity being directly proportional to their temperature. Their applications include: (1) Automatic limitation of starting current (protection of leads, motors, magnet coils, switching on of arc lamps, etc.); (2) automatic prolongation of the starting time (slow lighting up of incandescent lamps, slow starting of electric vehicles, lifts, etc.); (3) automatic delay in switching on (*e.g.*, in anode circuits of hot cathode rectifiers and relay tubes in delaying relays, etc.).

Salford Electrical Instruments, Ltd.

In a range of metal rectifier and thermo-couple instruments of unusual performance at high frequencies are voltmeters that may be used up to 1.5 Mc and ammeters up to 20 Mc; 0/20 A and 0/50 V are typical ranges. Current transformers of special design com pletely isolate the ammeter itself from the circuit, an important point when high voltages are used. Metal rectifier instruments cannot be damaged by 1,000 per cent. overload.

Precision dynamometer substandard instruments, developed to meet the requirements of the Electricity Supply (Meters) Act, include wattmeters, voltmeters and ammeters. Multi-volt and multi-current ranges are provided, the current ranges being changed by a patented system.

A new direct reading thermionic test set for battery or AC mains operation, for up to 20 Mc, operates on the valve voltmeter principle, the high sensitivity being obtained with an amplifier, and the circuit is arranged so that the indicating movement cannot be damaged by heavy overloads. Beside a general purpose miniature valve voltmeter with three ranges, another for the precision measurement of low voltages at very high frequencies has an "acorn" triode contained within an exploring head at the end of a flexible metal tube, thus permitting the valve to be brought within a very small distance of the point at which the voltage is to be measured.

A diode voltmeter for moderately large voltages at high frequencies provides several ranges by changing the plug-in electrostatic voltmeter, accuracy being within ± 3 per cent. at 100 Mc. A universal Q-meter with a very wide range of application has a frequency range of 100 kc/s to 5 Mc, while a heterodyne universal tester for the rapid checking and comparison of inductances and capacitances is accurate to within 0.1 per cent.

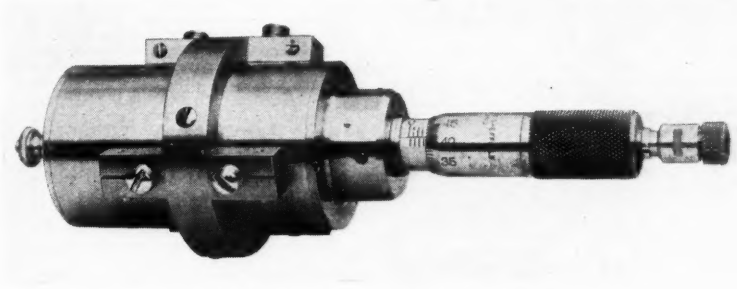
Instruments (illus.) for the measurement of the thickness of coatings of

Salford layer thickness meter

various non-magnetic types on magnetic bases operate by placing an exploring head on the surface of the material, an indication being given directly on the dial. They can be used with equal facil-

ity for measuring coatings on irregular objects such as tanks, drums, etc., or on flat or corrugated sheets. A sensitive type measures very thin layers, such as nickel plating.

In a new type of terminal developed specially for low-loss high-frequency apparatus, ceramic insulation is employed. Besides thermostats for the control of electric cooking and water heating apparatus and room temperatures, there were disc thermostats for motor protection.



Sullivan silica insulated micrometer condenser

Short & Mason, Ltd.

Besides electric contact mechanisms for indicating and recording appliances, the "Pavaex" medical outfit is an electrically actuated exerciser of the passive vascular type for automatically promoting collateral arterial circulation in human extremities, such as a leg enclosed in an appropriately shaped metal chamber.

H. S. Simons

"Dielcometers" are for the routine determination of the capacity of test samples of any kind of substance, providing a characteristic indication of their physical or chemical states. The principle is the heterodyning of a high frequency circuit stabilised by a quartz crystal with a testing circuit in which two variable condensers in parallel with the measuring cell or container allow quick repeatable precision measurements to be made.

Standard Telephones & Cables, Ltd.

A watch rate timer enables the timekeeping performance of a watch to be checked against a standard in a very short period, generally less than a minute. This is accomplished by picking up the ticks of a standard and test watch on a sensitive microphone, and, after suitable amplification, examining their relation on the screen of a cathode-ray oscillograph.

One of several transmission measuring sets is a mains operated, portable unit, with direct-reading and self-calibrating features: its accuracy over the measuring range of + 25 to − 50 db and the frequency range 30 to 10,000 cycles is of the order of ± 0.25 db. A direction finder for aircraft gives visual indication on a meter showing deviation right or left from the course.

There was a demonstration of standing waves produced from an ultra-high-frequency oscillator, using two "LS.486" valves, the frequency of oscillation being approximately 250 Mc. A range of valves for use at wavelengths of 2½ metres down to centimetre wavelengths are negative grid triodes employing close inter-electrode spacing to reduce the electron transit time and reduction of inter-electrode capacities by means of special assembly arrangements.

Among mercury vapour rectifiers for high-voltage power supplies, the type "4078-A" valve has a peak inverse voltage of 20,000, and peak anode current of 10A. Selenium rectifiers for from 75 mA to 10 A per disc were also displayed, together with magnetic dust cores for all types of coils working at radio frequencies; "Permalloy" nickel-iron alloys having very high permeabilities in weak magnetic fields, low hysteresis losses, and coercive force; samples of raw quartz crystals, and some applications of quartz crystals to radio-frequency control; and a sample of the Manchester-Leeds-Newcastle coaxial cable.

H. W. Sullivan, Ltd.

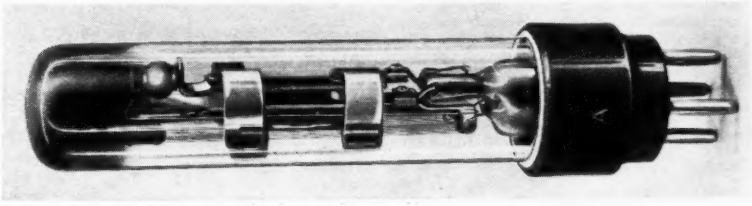
A silica insulated micrometer condenser (illus.), with a range of 5-13 $\mu\mu$F, has a scale accuracy of 1 part in 5,000. It is built to the design of the National Physical Laboratory and conforms to a perfect law of linear capacitance, thus ensuring a high degree of interpolation accuracy, desirable when measuring small capacitance changes.

An improved direct reading universal precision audio-frequency inductance bridge (any resistance), of exceptionally wide range and high accuracy (0.1 per cent.), compares the inductance to be measured with a four-dial constant resistance standard inductance of 0.05 per cent. accuracy. The accuracy of measurement is unaffected over a temperature range of 30-130 deg. F. Another improved instrument, a logarithmic capacitance bridge, has a uniform accuracy of 0.2 per cent. throughout the entire range and a scale accuracy of 0.1 per cent. throughout. Visual or aural detection of balance is possible.

In collaboration with Mr. R. J. Halsey, of the Research Section of the British Post Office, a beat tone oscillator has been developed on the lines of the Ryall-Sullivan oscillator, but having a much higher frequency range so as to be useful for the whole "carrier" range.

Sun-Vic Controls, Ltd.

The latest glass-enclosed vacuum switch is type "602 AV" (illus.), described as the smallest now available mounted on a standard four-pin valve base. It is rated at 4 A, DC or AC, and its hot-wire control circuit has a resistance of about 1,800 ohms, so needing 25 mA at 45 V for its operation. For use at normal supply voltages, it is therefore necessary to place an external resistance in series with the control circuit.



Sun-Vic type "602 AV" valve-capped relay

Type "4M" surge suppressor is quite small, containing a disc of "Metrosil," which is a ceramic material whose resistance varies with the voltage applied to it. The disc, 1 in. in diameter and 0.25 in. thick, is spring-clamped between metal plates and fitted with terminals.

The "Simmerstat" hot-plate control is an adaptation of the 2-kW energy regulator for mounting inside a cooker switch compartment in the position normally occupied by the three-heat switch, so permitting continuously variable control from zero to full load. There is also a current-limiting relay for disconnecting one load so long as another load exceeds a prearranged value. The bimetallic relays developed for these devices are convenient in themselves for laboratory purposes. They are sealed in evacuated glass tubes and immune to arcing and contamination of any sort. Trickle charging and timing relays for batteries are available also.

Synchronome Co., Ltd.

For ordinary accuracy in time measurement the electricity supply mains can render a valuable service to master clocks operating circuits of electrical impulse dials which, however good they may be, will accumulate an error if left alone. Accordingly a standard "Synchronome" master clock can have applied to it an ordinary synchronous AC motor, which synchronises it once every half-hour. The method is that of the heart-shaped cam as employed in stop-watches. One benefit from merely synchronising existing installations of electrical impulse dials is that the latter will continue to function undisturbed in the event of interruption of the electricity supply.

Taylor, Taylor & Hobson, Ltd.

The "Auto-Collimator" for measuring straightness and alignment of such articles as lathe beds and bearings comprises a telescope and mirror and incorporates the co-incidence principle. The instrument will register errors determined in terms of inclination of one part in one million and measurements of this order can be repeated. A sighting telescope and collimator system has been designed for setting up assembly jigs, etc., on which it is required to test the parallelism of a pair of bearings and the departure of the axes of the bearings from coincidence. The company's heat deflecting safety glass for welders' goggles and screens is now more durable than in previous exhibits. Large aperture lenses have been specially developed for the large screen projection of television.

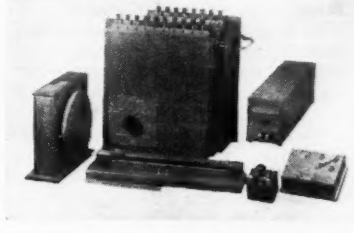
Telegraph Construction & Maintenance Co., Ltd.

"Telcon" metals were represented by curves showing the most recent improvements in characteristics which will be standardised for future supplies of these alloys. In the case of "Mumetal" and "Radiometal" higher permeability associated with lower electrical losses has been obtained, while "Rhometal" maintains its permeability in thin sheet form. Applications of these alloys for magnetic screening includes television.

Various types of "Telcon" high frequency cables now manufactured were exhibited, together with attenuation frequency curves. The company is now marketing low-loss, disc-insulated lead-sheathed trunk-type cables; flexible "Telconax" insulated, and air-spaced aerial feeders; also solid "Telconax" insulated leads for all frequencies, including the television band. Cables specially designed for broadcast relay working are available, and adhesive foil for electrostatic screening.

H. Tinsley & Co.

A stabiliser for maintaining applied voltage at a given value to within very narrow limits as, for instance, in the calibration of sub-standard indicating DC wattmeters has received the approval of the Electricity Commissioners, under the Meters Act. The applied (calibrating) voltage can be checked to equal any one of a number of standard voltages available on the standardiser selector switch. The checking is done by direct comparison with a standard cell, using a null indicating galvanometer. There is also an auxiliary unit in which the voltage drop across a fixed potentiometer circuit is



Instrument current transformer precision calibration equipment (Tinsley)

used to balance part of the applied voltage.

Instrument current transformer precision calibrating equipment (illus.) was developed in conjunction with the National Physical Laboratory. It is direct reading and measures the differences in ratio and phase angle errors between the transformer undergoing test and a calibrated, standard precision transformer. A new artificial horizon for producing a true horizontal plane is self-checking, and a general utility switch-operated Wheatstone bridge, available either with a built-in sensitive pointer galvanometer, or for use with an external galvanometer of the pointer or reflecting type, has an accuracy of 0.1 per cent. on all four decade dials, a ratio dial giving multipliers.

Ernest Turner Electrical Instruments, Ltd.

Miniature edgewise instruments have just been produced, although at present the straight moving coil model only is available. Small wire-wound resistances for use with an instrument and switch in cases where several ranges are necessary and panel space is very limited, resemble small tubular condensers, the wire spiral being moulded in solid bakelite.

The standard 2in. voltmeter has been modified to accommodate two ranges operated by a push-button actuated from the front of the panel. The top range possible at the moment is 300 V and a further modification is a spike and lead in lieu of terminals. Six-inch panel instruments now appear in their final form and present a flush-fitting appearance, yet are made to be withdrawn from the back of the panel. Bakelite instrument cases can now be fitted with either brass or iron screens, and are of the same dimensions and appearance as the normal cases. Double and triple scale indicators have been developed for the Marconi Co. for blind flying, while speed is the outstanding feature of this company's "power level" indicators.

Venner Time Switches, Ltd.

A light sensitive switch is based on a photo-chemical reaction in a glass container filled with equal volumes of hydrogen and chlorine gases. If this bulb is in darkness the gases do not combine, a gas pressure is built up in the bulb, and acts upon a thin glass diaphragm which in turn moves a mercury column and closes the circuit to be controlled. When the glass bulb is exposed to light the gases recombine, dissolve into the solution, and the pressure is reduced.

An A.R.P. switch (see illustration and further particulars on pages 7 and 8) carries out a switching operation of 5 sec. on and 3 sec. off, for 2 min., when the "alarm" button is depressed, and when the "all clear" button is depressed a continuous on period of 2 min. is given. An hour meter is fitted with cycloidal counter and will record time periods up to 10,000 hours if installed in a 50 cycle controlled frequency circuit. Among new types of time switches is a small and compact plug-in type of 10 A capacity, which can also be fitted with a solar dial.

Westinghouse Brake & Signal Co., Ltd.

Photographs were displayed to illustrate the many applications of metal rectifiers to electroplating, battery charging, cinema arc lamp operation, electrostatic deposition, general instrument requirements and telecommunication needs. Constant potential equipment is obtainable for floating battery systems and there is a patented static convertor for providing three-phase energy for cinemas in single-phase areas, so avoiding the heat flicker with shutter frequency caused by mains ripple. A lamp flasher without contacts has been patented for traffic-warning devices and advertising signs.

Weston Electrical Instrument Co., Ltd.

Among sub-standard and laboratory instruments were a wattmeter, ammeter and voltmeter of the portable electro-dynamometer type, with knife-edge pointers moving over mirror scales and having a guaranteed accuracy of 0.25 per cent. for full-scale deflection. The laboratory standard precision instruments of the moving coil type have 12 in. scales and a guaranteed accuracy of 0.1 per cent. for full-scale deflection.

Weston model "E772" super-sensitive analyser

Instruments for measuring or controlling light employ "Photronic" cells. Model "E.703-4" lightometer is a small pocket instrument having a scale that, in addition to being marked in foot-candles, is also marked with the lighting values needed for various locations and types of work. The new "850" exposure meter is a simplified and much cheaper version of the "650" meter. A photo-electric potentiometer of high speed and sensitivity, combined with permanently stable calibration, measures small currents or voltages and can operate a direct-writing strip chart recorder at high speed.

Besides radio-testing instruments (illus.) there are such aircraft instruments as electrical tachometers and indicators, engine synchroscopes, air temperature indicators, carburetter indicators, oil temperature indicators, cylinder temperature indicators, radio compass indicators, blind-landing indicators, thermocouples and leads.

Zenith Electric Co., Ltd.

A special feature of this company's laboratory resistances is the ease with which any part accidentally damaged may be removed and replaced without dismantling the entire rheostat. When fitted with bevel gears for angular drives clutches prevent damage by over-turning.

To meet the requirements of the Meters Act, a new range of loading resistances has been designed, capable of providing a complete and independent range of current and voltage. A phase-shifting transformer in which the indicating scale and mechanism has been redesigned, includes a double-ended vernier pointer, enabling the angle of lag or lead and the power factor to be read to a higher degree of accuracy.

"Variac" voltage-regulating transformers are variable by the rotation of a hand-wheel actuating a sliding brush mechanism and are equipped with calibrated dials. In other types the secondary voltage may be varied by a simple hand-sliding contact tracking on the secondary winding. These are useful in test rooms and laboratories. Wire-wound resistors embedded in a ceramic material fused to a smooth, glossy finish, although somewhat similar in appearance to the older vitreous enamelled types, differ materially in that the embedding material is much harder and is completely impervious to moisture, steam, oils, acids and alkalis.

Swiss High-voltage Testing Plant

HIGH-VOLTAGE testing plant has recently been put into operation at the works of the Société d'Exploitation des Câbles Berthoud Borel et Cie, at Cortaillod. It is a Brown, Boveri installation and comprises two independent transformer groups, each rated at 400 kV and arranged to be operated either separately, in parallel, or in cascade connection for testing cables and differs from plants for the testing of high-voltage machines and apparatus.

For tests during the course of manufacture and of finished standard cables, it has been found preferable to use AC at an industrial frequency, since the stressing of the dielectric is then identical with that met with in practice. For tests during development, however, DC provides valuable data, while it is often necessary to test drums of high-voltage cable by means of DC before they leave the works as the capacity of a cable drum is so great that the requisite capacitative wattless load cannot be produced by ordinary testing plants. Thus, for example, a 546-yd. length of cable of 150 kV rated voltage requires an apparent load of about 2,000 kVA when tested at 250 kV and 50 cycles.

These were the reasons which led the Cortaillod Works to base their new single-phase high-voltage testing plant on tests with AC up to 800 kV and with DC up to 1,000 kV, the continuously-rated loads of the plant being set at 800 kVA at 800, 400, 200 and 100 kV AC. Further, the design is such as to allow of switching over each set to 200 and 100 kV max. rated voltage while maintaining the continuously rated output at 400 kVA.

Convertor sets are inserted between the existing primary three-phase supply and the testing transformers, the advantage of this arrangement being that any magnitude of single-phase load can be generated without undesirable repercussions being transmitted back to the primary circuit.

The convertor sets run at 1,000 RPM and each comprises a 70-kW, 380-V, 50-cycle synchronous induction motor with overhung exciter and self-starter built on at one side directly-coupled to a 1,000-V star-connected, 50-cycle, 375-kVA three-phase generator with built-on main exciter and an auxiliary exciter driven by a three-phase induction motor at 1,500 RPM.

The two testing transformers, each of 400 kVA continuous rating at 1/400 kV, are identical in design. When they operate separately they can be overloaded, from cold, by 20 per cent. for 24 hours and by 30 per cent. for 15 hours. In cascade connection, the transformer forming the lower stage is also loaded, as regards its low-voltage windings, by that part of the load which is the share of the upper stage and it is, therefore, provided with two separately mounted tubular cooling radiators.

An eight-stage mechanical type of needle rectifier is built on to each transformer. By putting in suitable loop-shaped connecting pieces the changing over of the transformer high-voltage winding for 400, 200 and 100 kV can be carried out on the two lateral electrode supports. The inner shafts of both rectifiers, which carry the needles, are driven by a common synchronous motor placed in a pit. The stator of this motor, which starts up as an induction motor and has an additional winding for auto-excitation, can be rotated from the control desk by means of push-buttons and a servo-motor. By suitable choice of the position of the stator, it is possible to rectify either positive or negative half waves of the AC. The most favourable stator position is recognised from the control desk by the reduction in sparking.

Electricity Suppliers and Hire-purchase

By Eoin C. Mekie

THERE can have been few Bills more universally applauded than that which Miss Ellen Wilkinson sponsored and was passed into law during 1938. At the same time, however, in the case of electricity suppliers who sell electricity consuming appliances upon terms of payment by instalments, primarily as a means of increasing the sale of electricity to consumers, difficulties might have been experienced if credit sale agreements had not existed as an alternative to the hire-purchase system. Many authorities might well have required to raise the gross price of appliances sold under high-purchase agreements so as to cover the contingency of increased losses from default or return of goods—surely an unenviable prospect when all are striving to increase the electrical development of the country.

Credit sales as an alternative

Such a position fortunately need never arise since by now most supply undertakers will have received from their respective associations copies of the credit sale agreements made available by Edmundsons Electricity Corporation, Ltd., and some further explanatory notes on these forms may be of service to those who are uncertain as to the best procedure.

The areas of supply of the companies controlled by Edmundsons Electricity Corporation are very largely rural where the spending capacity of the average consumer is limited and accordingly, as a matter of policy, electric cookers and certain other appliances have for some time past been sold at a figure showing a strictly limited gross profit and in some cases even at or under cost. Doubtless many other undertakers follow a similar course, and the difficulties which the Hire-Purchase Act, 1938, might have created in that connection have been readily apparent to them. In the case, for example, of a cooker sold upon the basis of payment over a period of six years at a price which barely recoups the sellers' purchase price and cost of installation, if the cooker were sold under a hire-purchase agreement the right to return the appliance would not normally be considered by the hirer until one half of the instalments had been paid, as otherwise he would needlessly deprive himself of the right to use the cooker for a period in respect of which he still had payments to make.

Unwanted Cookers

At the end of three years, however, it is presumed that like all other branches of the electricity supply industry, technical advances will have been made in cooker design and the cooker would be of a type no longer regarded as the most up to date. The position then of the purchaser would be—"I am paying x/- per quarter which I can well afford to continue paying indefinitely. I have an absolute right to return the cooker when I have paid half of the instalments. I will return the cooker which I agreed to hire-purchase three years ago, obtain a cooker of the latest design and technique, possibly too at no greater quarterly cost to myself." From the consumer's angle that position would be ideal but the undertaker would be placed in a position of real difficulty, being faced with the problem of reconditioning returned cookers, incurring fresh costs in an endeavour to resell them, and possibly having to go on doing so two or three times until the cookers either found a permanent home or were scrapped.

In the case of a furniture or radio dealer who makes a satisfactory gross profit on each hire-purchase transaction, the purchase price being payable over 12 or 18 months (in some cases with a higher gross profit even longer) the provisions in the Act giving a right of return when half of the purchase price has been paid is not a matter of serious consequences.

For electricity suppliers, however, whose methods of business are so entirely different and who with other public utility undertakings alone in industry sell certain goods with little if any gross profit upon the basis of payment over a number of years, the consequences of carrying this contingent liability might be very serious in the event of any revolutionary change in design of electrical appliances or other occurrence resulting in the cancelling of hire-purchase agreements on a widespread scale.

In the case of Edmundsons' companies who (in common possibly with other undertakings, company and municipal) in order to develop their areas are selling current consuming apparatus to an extent of many hundred thousand pounds per annum on very favourable terms to consumers on the basis of payment by instalments, the assumption of that liability would necessarily have resulted in increased prices for appliances in order to make adequate allowances for contingencies.

A Favoured Position

It is as well, therefore, for the undertaker as well as the consumer who intends to honour his obligations, that any such situation which would affect the rate of the industry's development does not arise and that Parliament placed electricity supply authorities in a favoured position by Sections 24 and 25 of the Electric Lighting Act, 1882, and Section 16 of the Electric Lighting Act, 1909. In the case of the ordinary trader who does not, of course, have similar protection, when goods are sold under a credit sale agreement he ceases to have any security over the goods for payment of the purchase price and whether or not he has passed the property in the goods to the purchaser. It was that fact which led to the development of the hire-purchase agreement under which the seller sought to protect himself against (*a*) the purchaser selling the goods before all of the instalments of the purchase price had been paid; (*b*) the goods being seized by a landlord in distress for rent, in execution or any proceedings in bankruptcy.

Parliament, however, in 1882, exempted electricity supply authorities' apparatus for the purpose of providing supply from being so treated, and in 1909 extended the principle to current-consuming devices. In view of this there is little or no advantage in using the somewhat cumbersome form of hire-purchase agreement which secures no greater advantages than those obtainable by a simpler form which, moreover, does not lay the undertaker open to the dangers indicated above. In point of fact for some two years before Miss Ellen Wilkinson's Bill was introduced Edmundsons' companies had abandoned the practice of selling goods on hire-purchase and had been using without experiencing difficulties a form of agreement, of which Form D (reproduced herewith) is an adaptation, and which, in virtue of the statutory position mentioned, secures adequate protection of the companies' interests.

In view of the eminence of the counsel who were consulted and who approved the soundness in law of Forms C and D, it is probably unnecessary to enter in any detail into the questions of law which might be raised, that Form D falls within the definition of hire-purchase agreement contained in Section 21 of the Hire-purchase Act, 1938. True, it may be an agreement for the bailment of goods under which the property in the goods will pass to the purchaser, but it has been decided beyond any doubt in a long series of cases that in the absence of a right to return goods and thus terminate the hiring, no hire-purchase agreement exists but merely an agreement for sale. Further, it is clear from the Act itself that

CREDIT SALE AGREEMENT—FORM C.

I, the undersigned, hereby agree to purchase from The.....Electric Supply Company, Limited (hereinafter referred to as "the Sellers") as at this date, the apparatus described in the Schedule hereto (the cash price of which is £.....), on the following terms and conditions :—

1. I agree to pay for the apparatus (the total purchase price of which is £.....) by making a payment of £.....on completion hereof and by paying.....equal and consecutive quarterly instalments of £..... each thereafter and a final quarterly instalment of £....., such quarterly instalments being due and payable on the usual quarter days beginning on the first quarter day after the signature hereof: provided that (so long as I am a consumer of electricity supplied by the Sellers at the premises mentioned below) no quarterly instalment shall be deemed to be in arrear if paid within fourteen days of the rendering of the first account for electricity supplied to me at those premises rendered after the quarter day on which such instalment shall have become due, the first of such instalments not being included in any account rendered less than three months after completion hereof.
2. I agree that in the event of any quarterly instalment being in arrear for 14 days the Sellers shall be entitled to immediate payment of the whole balance remaining unpaid of the said purchase price.
3. I agree and understand that the Sellers accept no responsibility for the condition or maintenance of the apparatus and give no warranty as to its fitness for any particular purpose and that the guarantee (if any) given by the Manufacturers of the apparatus is the sole warranty or guarantee given as respects condition, maintenance, repair or fitness of the appliances which I hereby accept to the exclusion of any other warranty or condition express or implied.
4. This Agreement shall be completed when this Form (or a copy thereof) is returned to me signed on your behalf.

D

unless bailment means *hiring*, the Act is unworkable (cf. definition of owner and hirer).

Turning now to an examination of the clauses of Form D the following points arise :—

Clause 1.—The Act prescribes that the date or mode of determining the date upon which each instalment falls due must be stated and as it is customary in the industry for instalments to be invoiced at the same time as accounts for electricity supplied, it is obvious that where a continuous meter reading and accounting system is employed it is impossible at the time of making the agreement to state definitely when each instalment will be invoiced, and on this account the somewhat involved wording of Clause 1 was necessary.

Clause 2.—This clause is the kernel of the form since, in its absence, the goods would not belong to the undertakers as stated in the opening clause of Section 16 of the 1909 Act. It should be noted, however, that the second paragraph of Section 16 is so worded that in the view of some, Section 16 would extend to cover goods sold by undertakers the property in which had passed to the purchaser. In that event, however, difficulties, although not insuperable, would arise under the Bills of Sale Act and accordingly in the style in which Form D has been finally prepared, Clause 2 is one of the essentials.

Clause 3.—This clause follows very closely upon the wording of the agreement which was held not to be a hire-purchase agreement by the House of Lords in the case of *MacEntyre* v. *Crossley Bros., 1895, A.C. 457.* Under this clause the undertakers have the right to claim return of the goods in the event of any instalment being in arrear or if there is a breach of the conditions of the agreement. It will be noted that the terms of the clause are entirely just both to consumer and to undertaker, provided—and this proviso surely is unnecessary in the electricity supply industry—that the valuation made by the sellers is fair.

Clause 4 (a).—This is to avoid gas appliances being attached to cookers. (*b*) If the label is in position the consumer could not pass to a third party a good title to the apparatus under the provisions of the Factors Act, 1889, as the third party could

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CREDIT SALE AGREEMENT "D" No.

The Electricity Company Limited.

I, the undersigned, being the occupier of the premises specified below, hereby agree to purchase from The Electricity Company, Limited (hereinafter referred to as "the Sellers) the goods, appliances and/or apparatus (herein referred to as "the apparatus") described in the Schedule hereto (the cash price of which is £.....) on the following terms and conditions, viz. :—

1. I agree to pay for the apparatus (the total purchase price of which is £.....), by making a payment of £..... on completion hereof and by paying..... equal and consecutive quarterly instalments of £..... each thereafter and a final quarterly instalment of £....., such quarterly instalments being due and payable on the usual quarter days beginning on the first quarter day after the signature hereof: provided that (so long as I am a consumer of electricity supplied by the Sellers at the premises mentioned below) no quarterly instalment shall be deemed to be in arrear if paid within fourteen days of the rendering of the first account for electricity supplied to me at those premises rendered after the quarter day on which such instalment shall have become due, the first of such instalments not being included in any account rendered less than three months after completion hereof.
2. Until the last of the quarterly instalments has been paid the apparatus (though in my possession) shall remain the sole and absolute property of the Sellers.
3. In the event of any quarterly instalment being in arrear for 14 days or of my committing any other breach of the terms hereof, the Sellers may at their election (to be notified to me by registered letter addressed to me at the premises mentioned below) either (*a*) call upon me to pay the whole balance of the total purchase price then remaining unpaid (which shall thereupon become due and payable) or (*b*) require me to redeliver the apparatus to them and, in the event of my failing to deliver the apparatus within 3 days of being so required, may without further notice seize and resume absolute possession of the apparatus (and for that purpose may enter the premises mentioned below or any other of my premises where the apparatus may from time to time be or be reasonably thought to be). On any such return to or resumption of possession by the Sellers (i) if the sum of the instalments already paid and the then value of the apparatus as valued by the Sellers less the costs of recovery and of making good any damage to the apparatus (not resulting from fair wear and tear) be less than the total purchase price, the Sellers may recover the difference from me as damages for non-performance of this agreement; and (ii) if it be greater, the surplus shall be repaid to me; but if for any reason the Sellers shall be unable to recover or resume possession of the apparatus they shall be entitled to the whole balance of the total purchase price then remaining unpaid as liquidated damages for non-performance of this Agreement.
4. I agree that I will not until the last quarterly instalment is paid (*a*) fix or permit to be fixed any attachment to the apparatus without the previous consent of the Sellers in writing; (*b*) remove from the apparatus or permit the removal of any label indicating that the apparatus is the property of the Sellers; (*c*) in any way sell assign let charge or otherwise part with possession of the apparatus or (*d*) remove or permit the removal of the apparatus from the premises mentioned below without the previous consent of the Sellers in writing, which consent may be given subject to conditions.
5. I undertake to keep the apparatus in proper condition and repair (fair wear and tear excepted) and I agree and understand that the Sellers accept no responsibility for the condition or maintenance of the apparatus and give no warranty as to its fitness for any particular purpose and that the guarantee (if any) given by the Manufacturers of the apparatus is the sole warranty or guarantee given as respects condition, maintenance, repair or fitness of the apparatus which I hereby accept to the exclusion of any other warranty or condition whether express or implied.
6. This Agreement shall be completed when a copy hereof is delivered or sent to me signed on behalf of the Sellers.

Consumer's No.

Dated the.....day of.....19.....

Signature of Purchaser.....Occupation of Purchaser.....

Address of Purchaser's Premises .....

Witness..... Address of Witness.....

Signed on behalf of the Sellers .....

THE SCHEDULE

DESCRIPTION OF APPARATUS AND MAKER'S NO.	MAKER AND CATALOGUE NO.

Cash Price.	Add Interest.	Total Purchase Price.	Initial Payment.	Amount Remaining.	PAYABLE BY	
					Instalments.	Final Instalment.

CORRESPONDENCE

Every letter must be accompanied by the writer's name and address preferably, but not necessarily, for publication. The Editors cannot accept responsibility for correspondents' opinions

One Remedy for Bad Wiring

THE reference by "Nomad" in this week's REVIEW to the remark of Mr. Wallis about the purchase of just enough material to wire a house shows up the weak spot of the trade—that is, the ability of anyone to buy in small quantities at wholesale prices. According to Nuttall, wholesale is selling goods in large quantities. Therefore the remedy is to conform with this definition, and not sell cable of everyday use in less than one-mile lots, and switches, roses, and conduit, &c., in corresponding amounts. A contractor must be in a bad way of business if he cannot stock to that extent.

What is the good of a legitimate contractor, making a sound and perfect job, to have it ruined at a later date by a novice who, without let or hindrance, makes extensions or alterations with faulty and often dangerous results?

There should be a by-law that all additional work to a completed installation should be sanctioned by the proper authority. As a fitter of over forty years' standing, I have seen some weird and wonderful handiwork. JOHN.

January 2nd.

Another Bottle-neck

I have been a reader of your leading articles for some years. Naturally I have agreed with some of them, but not with that in the issue of December 23rd about the Kingston burn-out.

The public has a right to be "genuinely disturbed by an apparent increase in the number and length of interruptions of supply," but you do not, in my opinion, show the best way in which this increase can be prevented. There does not seem to be much doubt that, since the C.E.B. came into commercial operation, continuity of supply has not been so assured as it was prior to 1934. The shut-downs which took place in the earlier days of the grid could be put down to teething troubles which one can expect; those which have happened since are of a graver nature. The trouble is, and your article seems to agree with this point of view, that much of the switchgear at present in use cannot break the fault power which is available when protective gear comes into operation. You go further and suggest that switchgear is not available that will rupture a very severe fault current, for you say that "if physical segregation is not properly carried out, other plant becomes involved in, for example, a resulting fire."

If physical separation of plant items is your remedy for these shut-downs, it seems to me that most of the switch-houses in the country, including many which were built as late as 1934, and much of the plant of the C.E.B. will have to be scrapped, or a very large sum of money spent on a fresh layout of plant now barely five years old. When this has been done and all the "bottle-necks" eliminated, will the supply be assured of a greater measure of continuity than that experienced prior to 1934?

If my memory serves me well, I have the opinion that when the Act which brought the C.E.B. into being became law your point of view was that although you did not agree wholeheartedly with the scheme it was up to the supply industry to make the best of, perhaps, not a good job. The C.E.B. has been now in commercial operation for almost five years over the greater part of the country and has, perhaps, been as great a success as its sponsors expected but it has certainly done no better than its detractors predicted. When the scheme was under discussion little attention was given to the possible havoc hostile aircraft could do to a concentration of plant in England. Even if you eradicate all the "bottle-necks" on the entire electricity supply network, will the continuity of supply be assured with a considerable portion of the total generating plant under the control of the C.E.B. concentrated in few places?

Instead "of tapping the grid at more than one point" and spending large sums of money segregating items of plant, would it not be better to partition the country into smaller areas than those of the C.E.B. and so reduce the amount of power that would be able to feed a fault in any given area? If the proposals on electricity distribution as outlined in the White Paper of 1937 were made much more comprehensive so as to make one authority in each area responsible for generation and operation as well as distribution, there would be fewer black-outs. Nor would the selling price of electricity have to be increased because of lower thermal efficiency of these smaller generating stations. But as you say, "no time should be lost in working out a provisional scheme of this nature and in carrying it out . . . in the interests of continuity of supply in a national emergency." W. BLYTHE, B.Sc., A.M.I.E.E.

Burnley, *December 27th.*

Electricity on the Farm

In reply to Mr. J. F. Lamb's letter of December 14th I would like to assure him that I was writing of tractors of to-day and not of twenty years ago. There may be plenty of ten-year-old tractors at work to-day and they may have cost only £5 per year in upkeep, but to suggest that these tractors have been really at work is too absurd to require a reply.

But if the oil engine is such a great boon to the farmers how is it that we find them throwing out their stationary engines in the steadings (comparatively good, long-lived machines) and replacing them by electric motors fed with current at 2½d. per unit?

The electric tractor would be displacing what I know to be a short-lived machine and would (owing to increased current demand) be supplied with electricity at ¾d. per unit. There is simply no comparison, and although I have only driven an experimental electric tractor built purely to demonstrate what could be done, the experience was enough to convince me that starting handles, cylinders, big ends, radiators, magnetos and oil sumps are pure inventions of the devil.

ANDREW MCDOWALL.

Mungoswells, Drem, E. Lothian, *December 27th.*

Referring to the letter from Mr. Stevens in your issue of December 2nd, I would advise some of our electrical enthusiasts who still harp on the idea of electrical ploughing and cultivation to change their views. The electric plough operated by

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Electricity Suppliers and Hire Purchase (*Continued from previous page*)

not be held to have entered into a bona fide transaction when a label is attached to the goods stating that they are the property of someone other than the person purporting to sell. It is most important that the property labels shall be attached as required by the 1909 Act as otherwise the protection sought to be obtained will be lost. Sub-clauses (*c*) and (*d*) call for no comment.

Clause 5.—This clause is capable of variation in accordance with the individual practice of undertakers.

It will be noted that the agreement, not being a hire-purchase agreement, reserves to the undertakers a right of entry to the premises which could not be reserved otherwise.

While the industry is thus placed in an exceedingly favourable position in relation to sales on terms of payment by instalments, it cannot be expected that that favoured position would be allowed to continue if undertakers gave justifiable grounds of complaint of abuse of the protection which Parliament has provided. Legal rights and powers must ever be tempered with equity, and it is surely in accordance with the best traditions of the industry that no genuine case of hardship shall be dealt with otherwise than in a generous way. As stated, however, in the article on the Act which appeared in the issue of the ELECTRICAL REVIEW of May 13th, 1938, the primary objective of undertakers is to sell electricity and not appliances, and there is, therefore, no incentive for undertakers to indulge in "snatch back" or other similar practices.

Little has been said with regard to Form C also made available to undertakers (the relevant part of which is reproduced), but its use is obvious—certain appliances are not of a construction which makes it practicable to attach labels, but in such cases almost invariably the second-hand value of the article is such that it is scarcely worth while incurring the costs of its recovery in the event of default being made in payment. In such cases Form C would be used, no labels being attached to the goods and the undertaker would rely solely on the credit of the consumer to secure due payment of the purchase price of the goods sold.

While in general Forms C and D give, as I have shown, all the protection normally required by supply authorities against the risks incidental to sales where extended credit is given, the use of hire-purchase agreements may doubtless be considered desirable in the case of special transactions or special types of appliances. In such cases the style of agreement recommended by the various associations will doubtless be generally used. It should be noted that the Hire-Purchase Act, 1938, does not extend to Scotland or Northern Ireland.

an electric cable, alternately laid out and picked up on the field, is hopelessly unpractical. The alternative, the electrical adaptation of the steam cable ploughing system, is equally unpractical from the point of view of the agriculturist because of the capital cost involved in providing supply lines to the different arable fields on a farm and also the necessity of having to haul the equipment (plough, portable electric haulage winches and transformer wagon) from place to place by some independent means.

Owing to bad times, farmers have, in the majority of cases, exhausted their capital resources and those who still have money to spend outside their immediate working requirements, can, believe me, spend it to far greater advantage in directions other than investing in electrical ploughing equipment from which they will gain no real advantage over their present methods.

Let the electrical enthusiasts for developing the farm load in rural areas stress the utility of electricity supply for driving barn machinery, pumping, even driving a thrashing machine, as also lighting, heating and cooking—these are uses distinctly of advantage to the farmer who can afford the installation. To advocate the use of electric power for purposes for which, at the present time at any rate, it is ill-adapted, is doing, in my opinion, disservice to the electricity supply industry.

I speak from years of experience in the past as a chief engineer and manager of a well-known municipal electricity supply undertaking and since then for over seventeen years as a director of the oldest and largest agricultural engineering and implement manufacturers in the country, who also make dynamos and motors, electric traction equipment, etc.

Ipswich, *January 2nd.* FRANK AYTON, M.I.E.E., M.I.P.E.

"It's an Ill Wind . . ."

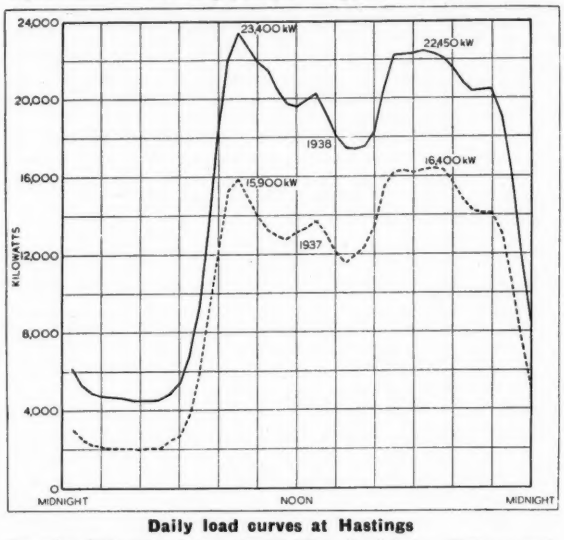
The Central Electricity Board will doubtless be in hearty agreement with the editorial in the ELECTRICAL REVIEW of December 30th on the benefits of the recent cold snap. By a comparatively negligible expenditure for additional fuel the Board has been able to sell a spectacular number of kilowatts to its tariff consumers.

The authorised undertakers who obtain their supplies under the Board's tariff, however, may have an entirely different story to tell. On the very generous assumption that the increased heating load was maintained for twelve hours on each day of the cold snap week the cost of the additional energy to an undertaker with less than 2,000 kW demand in, say, the South-East England Area would amount to £3 11s. 10d. per kilowatt of increased heating load, for which he would be lucky to obtain 1d. per kWh, or 7s. in all, from the actual user. In other words, neglecting the transmission losses, such an undertaker will be faced with a net deficit of £3 4s. 10d. for every kilowatt of the "ill windfall" load. C. BOLLAM.

London, S.W.1, *December 31st.*

Cold Weather at Hastings

I enclose a copy of my undertaking's load curve for December 20th, from which you will observe that the maximum load, *viz.*, 23,400 kW, occurred at 9 a.m. and was 42.7 per cent. higher than the evening peak in the previous year; the units



Daily load curves at Hastings

December 20th, 1938. Output, 373,900 kWh. Load factor, 66.58 per cent.
December 20th, 1937. Output 245,700 kWh. Load factor, 62.42 per cent.

used during that day in the undertaking increased from 245,700 to 373,900, or just over 52 per cent.

Practically all the increase is due to heating, there having been no increase in the power load during the year. It would be interesting to have examples of increases in other holiday resorts, also in any industrial town. A. J. RYAN,

Hastings, *January 2nd.* *Borough Electrical Engineer.*

Forthcoming Events

Institution of Electrical Engineers (*Meter and Instrument Section*).—Friday, January 6th. Institution, London, W.C.2. 7 p.m. "Instruments incorporating Thermionic Valves, and their Characteristics," by Messrs. E. G. James, G. R. Polgreen and G. W. Warren.

Informal meeting.—Monday, January 9th. Institution, London, W.C.2. 7 p.m. Discussion on "Recent Developments in Electro-Deposition," to be opened by Mr. A. W. Hothersall.

Mersey and North Wales (Liverpool) Centre.—Monday, January 9th. Liverpool Royal Institution, Colquitt Street. 7 p.m. "The Trend of Design of Electric Locomotives," by Mr. C. E. Fairburn.

North-Eastern Centre.—Monday, January 9th. The Newe House, Newcastle-on-Tyne. 6.15 p.m. "Plastics and Electrical Insulation," by Messrs. L. Hartshorn, N. J. L. Megson and E. Rushton.

Western Centre.—Monday, January 9th. South Wales Institute of Engineers, Cardiff. 6 p.m. "Electricity in Coal Mines," by Mr. R. Nelson.

An effective Christmas display at the Regent Street showrooms of Central London Electricity, Ltd.

Scottish Centre.—Tuesday, January 10th. 39, Elmbank Crescent, Glasgow, C.2. 7.30 p.m. "The Use of Protective Multiple Earthing and Earth-leakage Circuit Breakers in Rural Areas," by Mr. H. G. Taylor.

Hampshire Sub-Centre.—Wednesday, January 11th. Municipal College, Portsmouth. 7.30 p.m. "The Moving-Coil Voltage Regulator," by Mr. E. T. Norris.

Dundee Sub-Centre.—Thursday, January 12th. University College, Dundee. 7.30 p.m. "Administration and the Technical Engineer," by Mr. J. D. Campbell.

Association of Mining Electrical Engineers (*North-Western Branch*).—Saturday, January 7th. Engineers Club, Manchester. Annual dinner.

South Wales Branch.—Saturday, January 7th. Institute of Engineers, Park Place, Cardiff. 6 p.m. "Electrical Testing under the Coal Mines Act," by Mr. F. C. Knowles.

West Wales Branch.—Saturday, January 7th. "Faults on Plant in Service," by Mr. T. J. Howells.

Yorkshire . North-West Branch.—Saturday, January 14th Wakefield. "Colliery Cables," by Mr. F. D. Milner.

West of Scotland Branch.—Saturday, January 14th. Joint meeting with the Colliery Managers' Association (Scottish Branch). "The Standardisation of Mining Electrical Equipment," by Mr. W. Reid.

Electrical Power Engineers' Association (*London Local Group*).—Tuesday, January 10th. Caxton Hall, Westminster, S.W.1. 7.15 p.m. "Public Lighting," by Mr. E. C. Lennox.

Midland Technical Group.—Tuesday, January 10th. Corporation Electricity Department, Worcester. 7.15 p.m. "Legal Rights and Obligations of Engineers in their Employment," by Mr. J. W. Thomas.

Institution of Post Office Electrical Engineers.—Tuesday, January 10th. Institution of Electrical Engineers, London, W.C.2. 5.30 p.m. "Subscribers' Cable Distribution—Recent Developments," by Mr. L. Meek.

Illuminating Engineering Society.—Tuesday, January 10th. Film House, Wardour Street, London, W.1. 7 p.m. "The Lighting of Cinema Auditoriums as relating to Visibility and Safety," by Messrs. E. Stroud and H. C. Weston.

Diesel Engine Users' Association.—Wednesday, January 11th. Caxton Hall, Westminster, S.W.1. 4.45 p.m. "The Report on Heavy-Oil Engine Working Costs (1937-1938)."

Electrodepositors' Technical Society.—Wednesday, January 11th. Northampton Polytechnic Institute, Clerkenwell, London, E.C.1. 8 p.m. "An Electrical Method for Testing the Thickness of Deposits," by Messrs. J. W. Perring and W. Wozencroft. "The Evaluation of Throwing Power in Electrodeposition," by Mr. G. E. Gardam.

Salaries and Wages

Electricity Supply Industry

WE have received from Messrs. A. H. Banks and W. Arthur Jones, the joint secretaries of the National Joint Board of Employers and Members of Staff (Electricity Supply Industry), a review of the Board's past years' activities.

It is mentioned that Alderman W. Walker retained the chairmanship of the Board for the eighteenth year in succession, and Mr. L. Hoskison (president of the E.P.E.A.) was elected vice-chairman. The June meeting was held in Glasgow, when members were entertained by the No. 13 District employers and visited the Empire Exhibition.

In June the clause in the Supplemental Schedule under which salaries had been stabilised for three years expired, and the old basis of cost of living adjustment was revived and salaries were adjusted on the basis of 13 points. Under this calculation there was (by coincidence) no change from those previously paid under Schedule B of the Supplemental Schedule. The Board prepared and issued to all undertakers a booklet showing the classification under the Schedule of every constituent undertaking. This booklet will be revised every January and July.

The E.P.E.A. has submitted to various District Boards claims under the provisions of the new clause 39A for increased remuneration where the technical staffs claim they are called upon to perform increased duties and responsibilities in consequence of the undertakings operating in parallel with the Central Electricity Board. These claims have been remitted to the National Board, the District Boards having failed to agree, and the matters are at present under consideration.

Numerous grading appeals have also been referred by the District Boards and heard by the National Board during the past year, all of which have been amicably settled. The District Boards have also been required to deal with a considerable number of grading and other differences.

A notification has been circulated that as the cost of living figure has remained at about the same level there will be no alteration in salaries as from January 1st.

The National Council

Mr. Banks, in conjunction with Mr. T. Cochrane, the trade unions' secretary, has also sent us a review of the work of the National Joint Industrial Council for the Electricity Supply Industry during 1938. This notes a general tendency for the work of the National Council to increase year by year. Very many matters were referred from various districts and some were initiated nationally. An increase of ¾d. per hour was agreed by the National Council in December, 1937, and in May, 1938, the trade unions presented a further national claim for an increase of 2¼d. per hour. The Council disagreed and the claim was referred to the Industrial Court which decided against any further increase.

The trade unions in No. 10 District submitted a claim to the District Council for increased remuneration to men in charge of high-capacity units in turbine rooms and boiler houses. This claim is at present before the National Council, the District Council having failed to agree on the matter.

Many Districts have revised and reissued schedules during the year, and benefits to certain employés have resulted through increases due to zoning changes and improved conditions of service The District Council for Northern Ireland which came into existence during 1937 has now negotiated and submitted a schedule of wages and conditions of service to the National Council. There has been general agreement, and only a few grade rates remain unsettled.

The trade unions on the National Council raised the question of payment of wages during sickness applicable to the electricity supply industry generally. The employers have obtained particulars of sick pay schemes at present in force in the supply industry, and the Council is considering the matter.

The membership continued to increase and a further ten constituent authorities joined their appropriate District Councils. At the request of the trade unions the Council decided to recommend all Districts, who had not already done so, to issue notices setting out the benefits and advantages derived from the working of the District and National Councils, and recommending men to join a trade union represented on the Councils.

The National Council lost four valuable members: Mr. E. Huntsman, of Nottingham, who had rendered excellent services to the National Council since 1921, lost his seat on the Nottingham Council; as also did Mr. T. K. Briggs, of Middlesbrough. Councillor W. V. Stokoe, N.G.U. and M.W., retired, and Mr. H. Berry, A.E.U., died during the year. Alderman W. Walker occupied the chair until May, when he became vice-chairman and Mr. J. Rowan, E.T.U., was elected to the chair.

Here and There

By Nomad

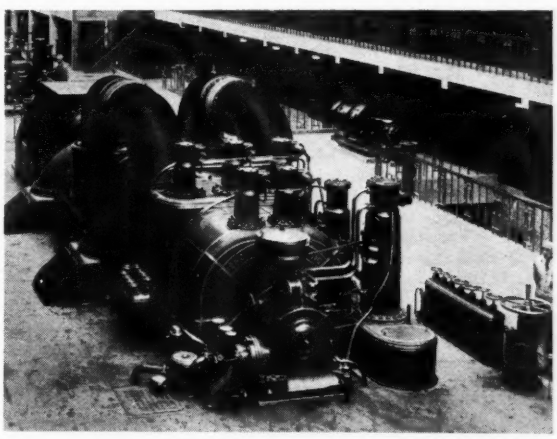
MAYBE I have a bias towards the generation aspect of electrical affairs, but I think the most fascinating story pertaining to electrical development is that of the relationship of the prime mover to the electrical industry. In the power station the turbine or engine is both servant and master while in the factory it is a serious rival to public supply as a direct driver and a close ally of the other sections of the industry when it is used for private generation.

* * *

Suggestions that power supply tariffs are uneconomical on the one hand and the accusation that oil engines are "given away" on the other, make me feel the more convinced that competition between the prime-mover manufacturer and the public supply does much good to the industry. Where process steam is required, however, arguments seem to be almost entirely in favour of the pass-out turbine, and I suppose that must inevitably be the case all the time 70 per cent. of the heat from the boiler is ejected into the condenser.

* * *

I cannot conceive any reasonable proposition other than private generation for a large industrial concern like the paper mills in Kent of Bowater-Lloyd, Ltd., where process steam



[Elec. Rev. photo

Turbine room in Bowater-Lloyds paper-mills power station

demand dominates the situation although the electricity output is similar to that of an undertaking for a city the size of Sheffield.

* * *

To be able to use waste heat in the prime mover presents another strong case for private generation and when this is coupled with the scientific regulation of the concern's own load, such, for example, as at the works of the Staveley Coal and Iron Co., Ltd., to the extent of attaining a 70 per cent. load factor, then an impregnable front is presented.

I think some supply men are too prone to stress only the advantages of public supply to the industrial consumer by way of relief from the responsibilities of electricity generation: most works managers with whom I have discussed this question consider such relief in terms of £ s. d. only. This is particularly the case in the coal and iron and steel industries, and Mr. Rothera, chief electrical engineer of Colville's, Ltd., told me that in his concern the amount of energy taken from the public system is dictated by such considerations as the present capacity of private generation plant, the selection of channels for expenditure of capital and the advisability of having an alternative supply.

* * *

Load factor is another thing which settles the rightful place of the prime mover. Mr. F. W. Wilkinson, chief engineer of Henry Wiggin & Co., Ltd., demonstrated to me recently how it was possible to save considerable sums on the supply account by a careful watch on the demand meters and by a specially designed works organisation by which fairly large loads can be switched off at the command of the electrical engineer.

* * *

On the other hand, when I visited the printing works at Andover of Kelly's Directories, Ltd., I was surprised to see how such a poor load factor as 8 or 10 per cent. is "nursed" to show healthy cost figures by the careful regulation of small prime movers on site. I am not sure whether I should congratulate the prime-mover manufacturer for the excellent showing at Andover or call his attention to many installations comparable to Kelly's that I know of on public supply.

Domestic Water Heating

Design and installation

THE scope for the electric heating of water for domestic purposes is indicated in an informative paper by Mr. J. I. Bernard (E.D.A.) which was read at the INSTITUTION OF ELECTRICAL ENGINEERS in London on January 5th.

Apart from the cost of electricity, largely counterbalanced by high efficiency of utilisation, there are many factors to be considered. Two households, similar in all respects, may use quantities of hot water which vary in the ratio of four to one; variations of 200 per cent. are common. Hence average figures can only be applied with great discretion. The energy consumed is almost in direct proportion to the use of hot water, the average use varying from 5 gal. per day in a working-class dwelling to 150 gal. or more per day in a large house where one or two servants are employed.

The use of hot water depends primarily upon personal habit and to a lesser extent upon the ease with which it is obtained and operating cost. The use of hot water often increases when electric heating is first adopted. The total possible consumption (12 million families) would amount to nearly three times the present figure and might reach 18,500 million kWh per year. In several towns in the south of England at least one consumer in four is now using electricity for water heating, but for the whole country there is only one water heater per twenty consumers, corresponding to a "saturation" of 5 per cent., which compares with 17.5 per cent. in Switzerland, 4.5 per cent. in Holland, 12.2 per cent. in Canada and 4 per cent. in the U.S.A.

The author reviews the trend of design, mentioning that 400,000 water heaters are estimated to be now in use in this country. The number of self-contained heaters in use is somewhat greater than that of immersion heaters, which should be regarded as complementary rather than competing types. Designs have become so stabilised that a British Standard Specification will soon be issued.

The need for tinning copper containers is debatable; it appears to be unnecessary, at any rate for heaters larger than 5 gal., water from which is not usually employed for culinary purposes. Higher loadings, with a corresponding recuperative period of four hours or less, are preferred to the Continental method of offering low tariffs for night heating.

Minimising Hard Water Deposits

Hard water scaling can be minimised by keeping the density of heat transmission through the surface of the heating element down to 10 W per sq. in. of surface, but the author says that it is probably preferable to make the element so long and so thin and of such a shape that its expansion and contraction are sufficient to fracture and throw off the deposit. Scaling is more serious in small heaters which are so extensively used, particularly the 1.5 gal. size, which is the modern counterpart of the large kettle on the hob.

Water authorities' requirements and installation problems as affected by practical conditions in houses, flats and commercial premises, are discussed in some detail by the author. As each hot bath requires a minimum of 10 gal. of water at heater temperature, the 20-gal. size is the smallest that can be used in houses requiring two hot baths in quick succession. The capital cost and space needed are fairly considerable, so that a tendency is becoming evident for the larger types to be manufactured in several shapes to fit into spaces which are otherwise of little value. This is one of the most important practical advantages of electric water heaters, and their adaptability is becoming known in the building industry. But the efficiency of most water heaters of this kind made up by builders does not compare favourably with that of the factory-made article.

"Circulator" elements have attained to great popularity, particularly in soft-water districts where copper cylinders are installed. They can be easily fitted vertically downward from the top of the container and provide quicker heating than do horizontal immersion elements. For reasonable operating cost, the latter need to be thermostatically controlled and the tanks lagged, though opinion is inclined to be sharply divided on the advisability of lagging. The author declares that there are fields for both sorts of installation; he suggests that hand-controlled unlagged installations are suitable for working-class consumers, whereas the more well-to-do should have lagged automatic systems for continuous service.

The author's comments on installation practice are practical, though brief. He believes that there is a considerable field for the application of self-contained water heaters in the equipment of new houses, their capital cost being offset by savings in tanks and pipework that would otherwise be needed. Apart from flats, there is in addition considerable scope for electric water heating in commercial premises, such as hairdressers' and other shops, offices and factories, typical figures for which (tabulated in the paper) are lower than those usually allowed for fuel-fired systems.

The last section of the paper deals with factors affecting policy, the various ways of charging for energy being described and the cost of supplying energy for different types of water heater analysed. There appear to be two policies among suppliers of electricity in this country, but neither is correct for all cases. In every town there are a certain number of consumers who require and can afford constant hot water service, but the majority can only afford the intermittent service obtainable by hand-controlled immersion heaters or "circulators." It is difficult to define the dividing line between the two classes and the value of their respective loads to the supply authority needs further study.

Generally the ordinary two-part tariff compares reasonably with alternative methods of charging, and leads to substantial consumption, usually much larger than that for cooking. The demand is so low and the consumption so high that water heating is the best of all domestic applications of electricity from the supplier's point of view.

Precise data relative to diversity in this country are difficult to obtain, but estimates tabulated by the author should be of assistance in calculating the cost of carrying the water-heating load. In future greater attention will probably be paid to more definite means of controlling the water-heating load so as to take advantage of its valuable storage characteristics.

The benefits to be obtained in this way may be applied either to the improvement of load factor with existing tariffs, or to enable lower tariffs to be quoted for securing additional load not otherwise obtainable.

Poynting's Law

A DISCUSSION on Poynting's Law in relation to the transmission of energy was opened by Prof. W. M. Thornton at a recent informal meeting of the INSTITUTION OF ELECTRICAL ENGINEERS in London.

It was explained that this theorem, discovered by Prof. J. H. Poynting in 1884 as a result of a mathematical examination of Clerk Maxwell's paper on electro-magnetic theory, had been taken too much for granted, and had been strangely neglected by compilers of textbooks; yet it was probably the most important law in engineering physics after Clerk Maxwell's exposition of the electro-magnetic theory of light.

Clerk Maxwell discovered that energy could travel in space and since the ether was a perfect insulator, said Dr. Thornton, it followed, though Maxwell did not apply it, that wherever energy was transmitted by electro-magnetic means it was carried by the insulation and only guided by the conductor along which it travelled. It was Poynting who found that the rate of flow of energy, *i.e.*, the power transmitted, depended equally on the electric field in the insulation and the magnetic field always associated with the flow of current.

In a study of electric generation the behaviour of insulation as carrier was more important than the metal of the windings. It was the circular magnetic flux around the conductors or coil edges that had to be considered.

The law of Poynting was universal in its application to all cases of the movement of electric charge and since all matter was electric, it followed that all energy was fundamentally electro-magnetic in nature and it applied to all cases of transfer of energy. Now there was always the direction of energy to be considered and Poynting showed that it must invariably flow at right-angles to both the electrical and magnetic fields in such a way that it was represented by the familiar right-hand vector.

Kempe's Engineer's Year Book

IN its early editions the information given in "Kempe's Engineer's Year Book" could be put into five or six hundred pages. Each year has brought increasing revisions and additions in order to keep the book up to date with current practice and the 1939 edition, the forty-fifth, contains 2,824 pages, giving in concise form the particulars, formulæ and tables required by engineers. Careful revision under the direction of the editor of *The Engineer* has been made and new details have been incorporated. The book is divided into two main parts. The first contains general principles and data, and the second, entitled "Descriptive Sections," gives information concerning the practical application of those general principles. The sections in both parts are numbered to correspond with each other, and full references to both parts are made in the comprehensive index. The descriptive sections have once more been extended, and in them will be found descriptions of the products of many important engineering firms. The book is profusely illustrated throughout by diagrams and half-tone engravings. The price of the book is 31s. 6d. and the publishers are Morgan Bros. (Publishers), Ltd.

New Southern Electrified Lines

Another forty-three route miles converted

ON New Year's Day electric service began over a further forty-three route miles of the Southern Railway Co.'s lines, bringing the total up to 664 and the track mileage to 1,665. The new electrified sections are from Virginia Water to Ascot and Reading; Ascot to Ash Vale and Brookwood; and from Aldershot to Guildford.

From the point of view of the supply and distribution system the new extensions are an addition to the existing network provided for the main line electrification to Aldershot and Virginia Water, carried out in 1937, concurrently with the main line to Portsmouth, where the main source of power supply is taken from the C.E.B. sub-station at Byfleet. By introducing a new source of supply from the C.E.B. Reading sub-station the extensions provide a further alternative source of supply to the Alton and Portsmouth lines. The connection into the existing Pirbright sub-station also has the effect of reducing the long stub and feed which originally extended from Byfleet to Alton sub-station. The sub-stations and track paralleling huts are unattended and are operated by supervisory control from Woking, where the existing control room has been extended to house the additional equipment required.

Knowle Hill sub-station

The 33-kV cables comprise three single-core unarmoured lead-covered cables (in the earlier schemes a three-core armoured cable was used), the three separate cables being laid simultaneously. The three separate joint boxes are kept close together and are neatly disposed so that the normal wooden troughing only need be slightly increased in dimension. The cables to the Reading C.E.B. sub-station were laid along the main Great Western Railway line, to which this sub-station has direct access. All extra-high-voltage cables are of 0.10 sq. in. section, with the exception of the Sturt Lane-Pirbright link, which is 0.20 sq. in. Altogether 114 single core miles were used.

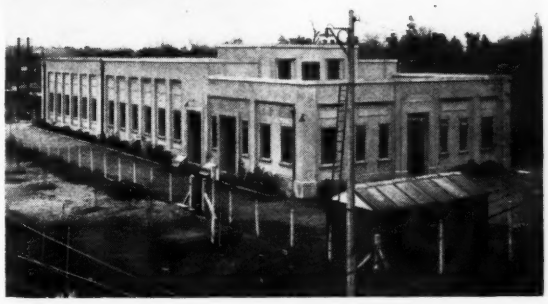
In addition to the equipment of ten new sub-stations, extra switchgear was provided at the existing Chertsey and Pirbright sub-stations, where the new supplies were introduced into the existing system. This work was carried out without interference with the normal traction or signalling supplies given by these sub-stations. The high-voltage switchgear is all of the outdoor type and is supported on reinforced concrete structures. The standard arrangement comprises three 33-kV oil circuit-breakers arranged as two incoming feeders with the third teeing off to provide the supply to the mercury arc rectifier equipment. This equipment is housed in a separate building adjacent to the outdoor structure and the supply of energy is made available *via* a rectifier transformer standing outside one end.

The completion of the extension increases the number of rectifiers in service on the S.R. Co.'s system to 99. These are all of identical type, rated at 2,500 kW continuously at 660 V DC, and thus represent one of the largest, if not the largest, rectifier installations in the country. An opportunity has thus been provided of gaining valuable experience in the maintenance of this class of plant, which has an overall efficiency at full load of about 95 per cent. and slightly better than this at half load. The mercury arc steel tank rectifiers are water cooled from a self-contained circulating recooling system housed in a separate annexe to the main sub-station building. This, together with the special recooler for the high vacuum pump and other auxiliary equipment, requires a separate auxiliary supply of approximately 7 kW. This is obtained from a three-phase auxiliary transformer mounted on the outdoor switchgear raft, together with similar single-phase transformers which provide supplies for signalling and oil switch motor operation.

An electric train at Ascot station

The rectified DC energy is distributed to the 660-V conductor rails by high-speed circuit-breakers rated at 2,500 A each, which can clear a short-circuit in 0.02 sec. These are housed in the sub-station building, which is designed in such a manner that all apparatus is mounted in the most convenient way for operation and maintenance.

The Woking control room has been extended. Previously there was accommodation for forty control panels, while now the capacity is eighty-seven panels. Actually only twenty-five new panels have been installed for the Reading extension, thus increasing the existing installation to sixty-five panels. The panels are arranged to represent in mimic form the whole of the main power circuits for the supply of electrical energy to the conductor rails. Each panel represents either a sub-station, track paralleling hut, or C.E.B. supply sub-station, and from these panels the required switching operations at any of these points are carried out.



Woking control room

The medium by which these operations are made is a selector system of remote control, which requires for its actuation a transmitter at the control room and a receiver at the sub-station.

The rolling stock comprises thirty-six two-coach motor train units of a similar type to those provided for the Portsmouth electrification. Each unit consists of a motor coach and a trailer with a driving position. The hand wash basins have "Heatrae" storage type electric water heaters mounted below.

The electric traction equipment of the motor coaches includes two Type 339 totally enclosed motors of 275 HP at the one hour rating, mounted on a motor bogie under the leading end. These motors are of the type the Southern Railway has standardised for its suburban and main line semi-fast stock since the commencement of the electrification of its lines and there are now in use 2,500 motors of this type, totalling 687,500 HP. The traction control equipment is of the underframe mounted electro-pneumatic unit switch type arranged for bridge transition.

The electric train equipment was supplied by the English Electric Co., Ltd.; low-voltage cables by British Insulated Cables, Ltd.; high-voltage cables by Pirelli-General Cable Works, Ltd.; high-speed circuit-breakers by the British Thomson-Houston Co., Ltd.; rectifiers and transformers by Bruce, Peebles & Co., Ltd.; switchgear and supervisory control gear by Asea Electric, Ltd.; and rail insulators by Taylor, Tunnicliff (Refractories), Ltd.

NEW ELECTRICAL PRODUCTS

A review of equipment recently marketed

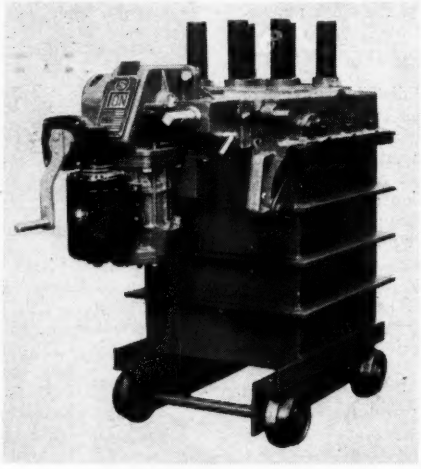
Motor-operated Spring for Closing Circuit-breakers

A MECHANISM has been devised by SWITCHGEAR & COWANS, LTD., Elsinore Road, Old Trafford, Manchester, 16, for the remote operation of oil circuit-breakers.

It consists of a spring storing enough kinetic energy when compressed by means of a universal 230-V motor, acting through worm and pinion gear, to secure closure of a circuit-breaker under fault condition; as the motor does not have to close the switch, its output is low, *e.g.*, ⅛ HP for a 250-MVA breaker. There are three alternative main operating sequences. In one, the motor reloads the spring as the breaker closes, the control circuit opening just prior to the closing point; after the breaker has opened, the spring is released for closing by energising the motor by the remote push-button control and is then again reloaded.

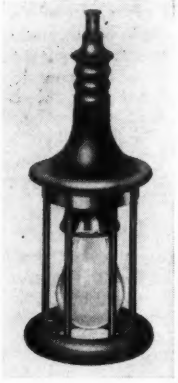
A second arrangement is to start the motor for loading the spring when the circuit-breaker opens and to cut off the supply immediately before full compression, the breaker being then closed again by depressing the push-button.

The third method is generally similar except that the spring is reloaded and the circuit-breaker closed only after the push-button has been depressed for about eight seconds.



S. & C. motor-operated spring closing mechanism fitted to a 150-MVA internal isolation circuit-breaker, showing the emergency handle fixed in position

Should the motor or the supply of electricity to it fail, the spring can be reloaded by means of a handle fitted to the gear-box; the operator can ascertain the point of full compression and can leave the spring mechanism ready for closing the breaker, which can later be effected by one or two turns of the handle. In order to facilitate maintenance, the breaker can be closed by the handle when the top plate is raised. In addition, an emergency operating handle is supplied here so that the switch could be closed directly by hand in the event of spring failure. Short-circuit between the pilots would not cause operation.



New "Nettle" hand-lamp

Shockproof Handlamps

The new all-insulated "Nettle" shockproof handlamp of VICTOR H. IDDON, LTD., Harper Road, Wythenshawe, Manchester, is available in two forms. Model 37 has a solid resilient rubber handle with a flexible cable entry and a H.O. approved lampholder with a bakelite skirt, and a steel reinforced all-insulated unscrewable guard, fitted with rubber buffers to protect the lamp from damage. The watertight handlamp (Model 39) has a similar handle for flex up to ½-in. in diameter, while the lamp is protected by a Gauge 9 welded non-corrosive metal guard tightly screwed over solid rubber. The glass cover is sealed on to a rubber flange.

Condensers for Neon Signs

From the Radio Works of FERRANTI, LTD., Moston, Lancs, we have received details of a range of condensers for power factor correction of neon signs. They are of compact construction, suitable for conduit entry, incorporate a discharge resistance, and are tested at a voltage twice as great as their normal DC working voltage and three times greater than their AC peak working voltage.

In the can type of condenser close proximity of the terminal to the outer metal case may produce a parallel conducting path and thereby reduce the total effective insulation resistance. To prevent this happening the terminal must have an infinite resistance and all terminals are, therefore, subjected to the necessary tests before assembly. Terminals to case are tested at 2,500 V DC and between terminals and terminals to case tests are made at 1,250 V DC. In carrying out capacity tests a tolerance of ±15 per cent. of their nominal capacity value is allowed.

Multiple connections to electrodes are provided to ensure a low power factor. All condensers are built to tropical specification, *i.e.*, each unit is buried in a high-melting-point bituminous compound flamed to the case sides to prevent ingress of moisture during variation of outside temperatures. Porcelain to rubber joints are dispensed with; pure linen and "Kraft" paper tissue are used. The papers are free from acids, alkalis or bleaching materials, and it is claimed that they do not disintegrate with age.

The condensers are available in capacities from 5 microfarads to 100 microfarads with a maximum AC working voltage of 265 V or 309 V.

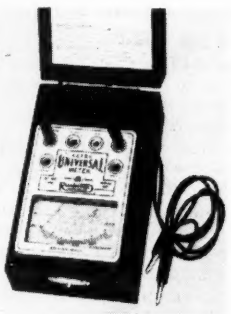
Multi-range Meter

Notification has been sent to us by RUNBAKEN ELECTRICAL PRODUCTS, 13, Liverpool Road, Deansgate, Manchester, 3, of a mains "Multimeter" which is suitable for AC and DC with measuring ranges of 0-500 V, 0-16 V, 0-10 A, 0-30 mA and 0-100 W. It is supplied complete with leads in a leatherette case.

New Switches

Several additional switches are included in the new catalogue, No. 180, of J. A. CRABTREE & Co., LTD., Lincoln Works, Walsall.

Both the circular and rectangular pattern of the "Lincoln" surface switches are now available with the type "T.O.G." (silent toggle) movement, while the 5- and 15-A switch assemblies in iron boxes have adjustable grids. There is also a "Lincoln" switch-socket of the 2-A, two-pin type, rectangular in shape and fitted with a deep porcelain base. This switch is unique in that the internal wiring can be changed so that the unit can be used as an ordinary switch-socket or as a switch for a lamp in the centre of a room, with an unswitched 2-A outlet; it is in this form that it is employed in connection with the company's campaign "Make every point a lighting point."

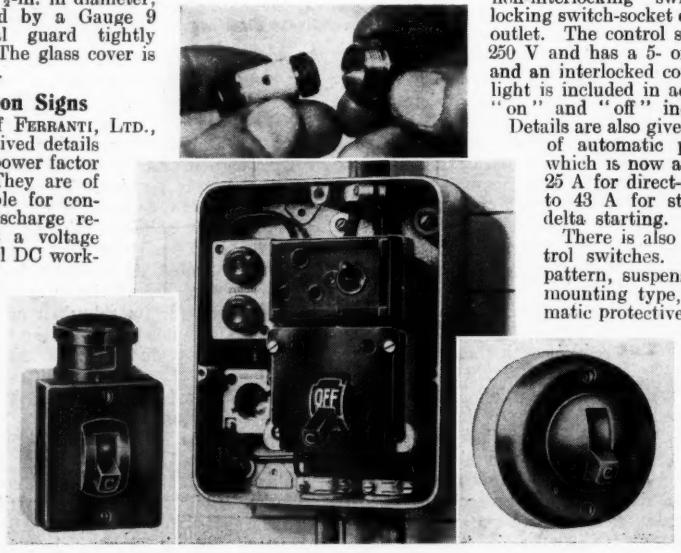


The Runbaken "Multimeter" described above

Another new product is the range of cooker control units made to B.S.S. 438/1936. They are of pleasing design with rounded corners and are available with a non-interlocking switch-socket, an interlocking switch-socket or only a shielded socket outlet. The control switch is rated at 30 A, 250 V and has a 5- or 15-A auxiliary circuit and an interlocked cover. A pilot indicating light is included in addition to a mechanical "on" and "off" indicator.

Details are also given of the extended range of automatic protective control gear which is now available, rated at up to 25 A for direct-on-line starting and up to 43 A for star-delta and auto-star-delta starting.

There is also a series of remote control switches. The surface-mounting pattern, suspension pattern and flush-mounting type, all for use with automatic protective control gear, are available in sizes of up to units embodying six buttons. "Semi-standard" remote control switches are made in three different forms, namely, with a "mushroom" type "Stop" attachment, as a protective type "Selector" switch or in the form of a watertight remote control switch.



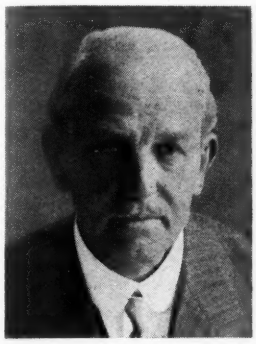
Left to right: The Crabtree 2-A switch-socket, cooker control unit, and round tumbler switch. Above: The cartridge fuse employed

PERSONAL AND SOCIAL

Information regarding new appointments and other matters of interest for this page are welcomed

THE New Year Honours List was published on Monday last, and we give below the names of the gentlemen connected with the electrical and allied industries upon whom honours have been conferred :—

Councillor E. R. Canning, J.P., chairman and managing director of W. Canning & Co.; **Mr. H. S. E. Vanderpant,** chairman of the London and Home Counties Traffic Advisory



[Elec. Rev. photo.
Sir Frank Smith

[H. J. Whitlock & Sons, Ltd.
Councillor E. R. Canning

Committee; and **Alderman G. G. Craig,** a director of Cryselco, Ltd., have had knighthoods conferred upon them.

Sir James H. Jeans, M.A., D.Sc., LL.D., F.R.S., has been awarded the Order of Merit, and **Mr. C. G. Graves,** Deputy Director-General, B.B.C., becomes a G.C.M.G.

Mr. T. St. Quintin Hill, C.M.G., O.B.E., Comptroller-General, Department of Overseas Trade, receives the K.C.M.G.

Sir Frank Smith, K.C.B., C.B.E., D.Sc., LL.D., F.R.S., secretary of the Department of Scientific and Industrial Research, is awarded the G.B.E., and the O.B.E. (Civil Division) is awarded to **Mr. W. F. Higgins,** Secretary, National Physical Laboratory, Department of Scientific and Industrial Research; **Mr. A. G. Ramsey,** M.B.E., M.Inst.C.E., M.I.E.E., Senior Engineer, H.M. Office of Works and Public Buildings; and **Councillor H. W. Sellers,** director of G. Casperson, Ltd. **Mr. E. W. Knight,** A.M.I.E.E., Assistant Engineer, South Midland District, G.P.O., becomes an M.B.E.

In the India Office List, **Major H. G. Howard,** C.I.E., M.C., Chief Engineer for Electricity, Madras, is knighted, and **Lt.-Col. M. G. Platts,** O.B.E., M.C., Indian Service of Engineers, Superintending Engineer, Electricity Department, Madras, becomes a C.I.E.

To mark the occasion of the seventieth birthday last July of **Mr. M. J. Railing,** vice-chairman and joint managing director of the General Electric Co., Ltd., employés of the company at home and overseas decided to present him with a portrait of himself. This was painted by Harold Knight, R.A., and was presented to Mr. Railing a few days before Christmas, together with an illuminated address and a silver bowl.

The portrait of Mr. M. J. Railing by Harold Knight, R.A.

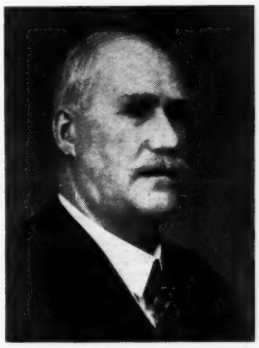
Mr. R. W. Towers has joined the staff of the Rheostatic Co., Ltd., Slough, and will be attached to the London office at Steele House, 11, Tothill Street, S.W.1.

Mr. Willis Jackson, D.Sc., D.Phil., A.M.I.E.E., of Burnley, Professor of Electrotechnics at the Victoria University of Manchester, was married on December 28th at Bowdon Parish Church to Miss Mary Elizabeth Boswall. Dr. Jackson has held his position at Manchester University since September 29th last and was previously a member of the Research Department of the Metropolitan-Vickers Electrical Co., Ltd. He is a member of the Committee of the North-Western Centre of the I.E.E.

An interesting little ceremony took place during this year's Tucker "Panto-Night" on December 30th at the Theatre Royal, Birmingham, when Miss Evelyn Laye presented on behalf of the directors of J. H. Tucker & Co., Ltd., a gold watch as a mark of appreciation to sixteen employés, including three ladies, each of whom had, during 1938, completed twenty-five years' continuous service with the company. In addition to the sixteen with twenty-five years' service mentioned above there are twenty-four with over twenty years to their credit, fifty-seven with over fifteen years and ninety-seven with over ten years.

Mr. H. Vernon, a director of Thos. W. Ward, Ltd., and manager of the Machinery Department, has been elected a director of Marshall Sons & Co. (Successors), Ltd., Gainsborough, in place of the late Mr. W. A. Ward.

Mr. W. Marsh, who will be retiring from the position of engineer and manager of the Brighton Corporation Tramways Department on half pay at the end of next April, will have completed forty years' municipal service. He received his early electrical training in Glasgow, and is one of the late Professor Jamieson's pupils. From the Engineering Department of the Glasgow City Tramways he went to Brighton in 1900 to help plan the Brighton Corporation Tramways. He has been manager since May, 1905, and accordingly claims to have had a longer period as a municipal tramway manager than anyone else in this country. He took over the undertaking when it was in very low water, and will leave it not only clear of debt, but with big reserve funds. The undertaking will shortly be changed over to trolley buses. On April 1st, 1939, the Brighton Bus Co. will take over the traffic control, and the fixing of all fares after 1942.

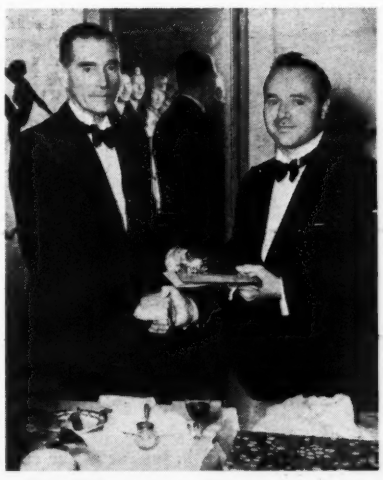


Mr. W. Marsh

Miss Rena Murphy, demonstrator with the Electricity Supply Board, Dublin, has been awarded the Elizabeth Sloan Chesser Cup for demonstrators by the Electrical Association for Women for the year 1939.

Mr. H. G. Weaver, M.I.E.E., has been appointed chief electrical and mechanical engineer of the Whitehead Iron and Steel Co., Ltd., and its associated companies, Whitehead Hill & Co., Ltd., and the Whitehead Thomas Bar and Strip Co., Ltd. Mr. Weaver was chairman of the Western Centre of the Institution of Electrical Engineers in 1937-1938.

About 400 employés of the Midland Electric Manufacturing Co., Ltd., attended the annual dinner and dance at Tony's Ballroom, Hurst Street, Birmingham, on December 23rd. At this function it is the practice of the managing director, **Mr. W. L. Barber,** to present a gold watch to all employés who have completed ten years' continuous service with the company. Twenty-one awards were made this year, bringing the total number to 180. As 1938 was the thirtieth anniversary of the founding of the company, the holders of this long service award returned the compliment to the managing director when they presented him with an onyx desk set with perpetual calendar, together with an illuminated address signed by all the subscribers, as a token of their appreciation.



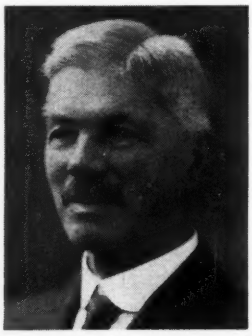
Mr. W. L. Barber (left), managing director of M.E.M., receiving a presentation from Mr. A. Wynn, general manager

Mr. E. V. Boddis, resident engineer of the Electricity Company of Macclesfield, Ltd., who has been temporarily in charge

of the electricity undertaking in the island of Madeira for some months, has been permanently appointed to that position. Both companies are subsidiaries of the Electric Developments and Securities Trust, Ltd. No appointment of a successor to Mr. Boddis in Macclesfield has been announced, but **Mr. H. L. Howard** is temporarily acting as resident engineer.

Mr. J. K. Brydges, M.I.E.E., borough electrical engineer at Eastbourne, is retiring upon superannuation after thirty years' service with the Corporation, and **Mr. N. Boydell,** A.M.I.E.E., A.I.Mech.E., chief assistant borough electrical engineer at Eastbourne, has been appointed to succeed him. Mr. Boydell received his technical training at the Leigh and Liverpool Technical Colleges, and started his engineering career with Sutcliffe & Speakman at Leigh, receiving his electricity supply

Mr. N. Boydell



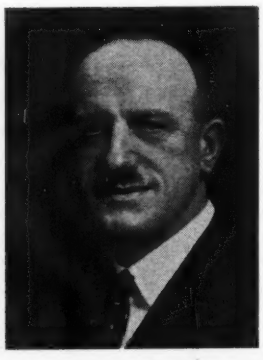
Mr. J. K. Brydges

training with the Leigh (Lancs) undertaking. In 1925 he became third assistant mains engineer at Southport, later being promoted to second assistant mains engineer. Mr. Boydell was appointed district engineer with the Bedford Corporation electricity undertaking in 1929, in which position he was responsible for extensive development work in connection with the rural demonstration scheme of the Electricity Commissioners. He went to Blackburn in 1932 as assistant mains superintendent and about five and a half years ago joined the Eastbourne undertaking as mains engineer, from which position he was later promoted to chief assistant borough electrical engineer.

Mr. W. L. Shand, M.I.E.E., late of Merz & McLellan, has joined the staff of E.D.A. as its representative in charge of the Electrical Section of the Building Centre, 158, New Bond Street, W.1. He is assisted by Miss V. G. Hammond, who is specially qualified by training and experience to advise visitors to the Centre on the domestic uses of electricity.

The jolliest and best attended party they have had for many years was held by the London staff of Crompton Parkinson, Ltd., at the King's Hall, Holborn Restaurant, on December 30th. **Mr. Frank Parkinson,** who presented long-service medals to several members of the staff, replied to the toast "The Company," with an encouraging speech, but although there were one or two further speeches, the greater part of the evening was devoted to dancing and cabaret. Over 300 were present.

Mr. T. G. Spencer, managing director of Standard Telephone and Cables, Ltd., has been elected chairman of the Cable Manufacturers' Association for 1939. Mr. Spencer has been prominently associated with the cable industry for over thirty years and is recognised as one of the leading authorities on this subject both in this country and abroad.



Mr. T. G. Spencer

Mr. William Preston, J.P., managing director of Wm. Sanders & Co. (Wednesbury), Ltd., recently entertained the staff and workpeople to a dinner and dance, over 300 employés attending. There were also about 100 guests of Mr. and Mrs. Preston. After dinner Mr. G. Baylis (the company's technical adviser), on behalf of the staff and workpeople, presented Mr. Preston with "the essential parts" of a motor car radio set and promised that the complete apparatus would be installed in his car at the earliest opportunity.

Mr. W. Pratten, assistant mains superintendent and mains engineer to Leeds Corporation Electricity Department, has retired after nearly thirty-nine years' service, having joined the undertaking in 1900. Mr. Pratten received a presentation from the staff on December 30th.

Over 300 employés of Ensign Lamps, Ltd., enjoyed the seventh annual party in the form of a cabaret, supper and dance which was held recently at the Winter Gardens, Blackpool. Among those present were Messrs. J. W., W. V., and F. T. Green, managing directors of the company.

Mr. J. Day has now severed his connection with the Selson Machine Tool Co., Ltd., and has been appointed technical director to James Day (Machinery), Ltd. Mr. Day has just returned from another visit to the United States where he has been studying the latest developments in connection with the firms which his new company represents.

Mr. R. F. Markham, Assoc.I.E.E., has been appointed assistant engineer from January 2nd by the Burton-upon-Trent Corporation Electricity Department. Mr. Markham, who has resigned his position with Johnson & Phillips after nearly twenty years in the Contract Department, was on the staff of the consulting engineer, assisting in the electrification of the London, Brighton & South Coast Railway before the war, and during the war served in the R.A.F.

We regret to learn that **Mr. C. H. Yeaman,** M.I.E.E., city electrical engineer, Stoke-on-Trent, is gravely ill. Our readers will join us in wishing him a speedy recovery.

Mr. R. T. Fleming is succeeding **Mr. E. S. Barralet** as manager of the insulating varnish department of Pinchin, Johnson & Co., Ltd., as from January 1st. Mr. Barralet still retains his interest in the company as a member of the board of directors.

Mr. C. H. Frost, who joined the Westminster Electric Supply Corporation (now merged in Central London Electricity) in 1890, retired on December 31st, after nearly forty-nine years with the Westminster Company. Joining as an office boy, he spent the first two years at the old offices at 32, Victoria Street, but for the last forty-seven he has been at the headquarters at Eccleston Place, which the Westminster Company took over in 1892. For many years in charge of the Consumers' Accounts Department, he was appointed registrar to the Westminster Company in 1931, and on the amalgamation of the Central London companies he was appointed engineering office superintendent at Eccleston Place. About 100 colleagues gathered together at the "Barley Mow," Victoria, on December 30th at a dinner in his honour and to unite in expressing their good wishes upon his retirement. Presentations on their behalf, and also on behalf of the board of Central London Electricity, were made by the managing director, Mr. C. Parker.

Mr. C. H. Frost

OBITUARY

Mr. J. J. Gittings.—We regret to announce the death which occurred recently of Mr. Joseph James Gittings, governing director of Gittings & Hills, Ltd., paint and varnish manufacturers, of Birmingham. Mr. Gittings's first association with the trade was when he bought the business of his brother, Mr. Isaiah Gittings, and with the late Mr. John Boothby formed the firm of Gittings & Boothby. The works were then situated in Park Lane, Aston, but in 1896 there followed an amalgamation with Hills Bros. & Co., whose works in Nechells stood on part of the site occupied by the present company, the business then being known as Gittings & Hills & Boothby, Ltd. Mr. Gittings was one of the moving spirits in the formation of the Federation of Paint and Varnish Manufacturers, and was also one of the founders, and first chairman, of the Midland Branch of the National Union of Manufacturers. He was also active in local public affairs.

Mr. Harry Pool, former general manager of the Leicester City Transport Department, died at his home in Leicester on December 26th. He had been in ill-health since February, 1936, and retired in September of that year, but his health did not improve. He was sixty-two years of age, and leaves a widow and two daughters. Mr. Pool entered the Leicester City Transport service in 1890 as a junior clerk in the accounts department. He was chief clerk and cashier when the Corporation took over the undertaking in 1901, and he was chief accountant until 1926 when he became assistant manager. Two years later he was appointed general manager and held that position until his retirement.

Mr. J. F. Russel.—The death has taken place at Edinburgh at the age of forty-one of Mr. James Forrest Russel, who was trained as an electrical engineer at the Heriot-Watt College. During the war Mr. Russel served with the Royal Air Force. He was lecturer in technology at the Royal Scottish Museum, Edinburgh. Mr. Russel had been in indifferent health since the war, and for the last four weeks was ill with pneumonia.

Monsieur G. Tochon.—The death recently occurred at Viroflay, near Paris, of M. Gabriel Tochon, the managing director of the French Chambre Syndicale des Forces Hydrauliques, who was well known for his work in connection with the development and utilisation of the water power resources of France.

Electrical Materials during 1938

A review of price movements and events affecting the production and sale of commodities in the past year, prepared for the "Electrical Review" by the Metal Information Bureau, Ltd.

Copper

THE past year has been one of considerable activity in the copper market, although from a trading point of view 1938 was definitely not such a good year as its predecessor. The sharp recession in industrial activity at the end of 1937, both in America and in Europe, gave the copper market a poor start, but this was offset to a considerable extent, so far as producers of raw copper were concerned, by a big expansion during the past year of armament buying, which included in the case of Germany and Russia, and to a lesser extent other countries, the accumulation of war stocks of raw copper. As a result the market experienced growing tightness in supplies with production restricted to 105 per cent. of standard under the output control scheme until July 1st and to 95 per cent. from July 1st to October 15th. Prices began to move up fairly rapidly, and eventually all restriction on output was removed on October 15th. This, however, seemed to coincide with a fresh slowing down in industrial demand, and in December it became necessary once more to impose restriction on output, which was cut to 105 per cent. on December 15th and opens 1939 at 100 per cent. This output control scheme is not fully comprehensive, but comprises most of the largest copper exporting countries, with the partial exception of the United States.

The consumption of copper for electrical purposes in Europe has remained at quite a high level owing to the fact that nowadays almost every branch of armament expenditure involves electrical equipment of some form or another. Copper wire makers have been the busiest section of the consuming trades in this country during the past year and anticipate continued good business in 1939. For purely industrial purposes, however, business has been far from satisfactory, and unfortunately the prospects for the early months of 1939 are not a great deal better, although undoubtedly a further improvement in the American situation would help to improve sentiment in Europe. Until the war clouds disappear, however, there can be no real confidence.

Probably the outstanding feature of the past year has been the very heavy buying of copper by Japan, Germany and Russia. The first-named country has been taking the metal avidly owing to its war in China, but local consumption has been heavily curtailed on account of foreign exchange difficulties. Russia in the early months of the year bought very heavily at favourable prices, but was rather less active in the second half. Germany bought increasingly up to the Munich crisis, but since has been less in evidence, partly owing to the fact that she has now accumulated a very big reserve, and partly owing to increasing foreign exchange difficulties. This suggests that the Reich may be a less important buyer in 1939. America, after a bad start, showed steady improvement throughout the year, and is generally expected to show further recovery this year.

An important feature is the way producers within the control agreement latterly have been using quota decisions to try to influence prices, their idea being apparently to maintain standard copper somewhere in the neighbourhood of £45 a ton. There is a possibility, therefore, that during 1939, if this policy is pursued, copper prices may be kept more stable than in recent years.

* * *

Lead

Whilst world consumption of lead last year was fairly good, this was partly accounted for by the recovery in America, and the European market has not been a particularly satisfactory one. Armament demand (including war stocks) by Continental countries, and big Japanese takings have helped to absorb output, but stocks showed an increasing tendency, and in September the Lead Producers' Association was formed, whose object is to balance supply with demand. No official statements regarding curtailment of output have been made, but it is understood that action is being taken to try and stabilise prices in the neighbourhood of £16 a ton, until such time as trade demand justifies a higher quotation.

Cable makers have been one of the brightest spots in the lead consuming trades. The building industry, which has been so active in recent years, has suffered a definite decline. Battery makers have taken quite a lot of lead, the diminished motor car output being offset, to a considerable extent, by increased armament work, including some big contracts for submarines. Imports into the United Kingdom have been at a high rate, and in view of the undoubted reduction in consumption compared with 1937, there would appear to be a lot of lead held in reserve in this country.

The trade outlook in 1939 depends mainly upon political considerations, but sentiment would no doubt benefit from any further improvement in American industrial activity. In view of the large productive capacity of the world, and the continued efforts of certain countries to achieve self-sufficiency, it seems unlikely that consumers of lead will find much difficulty in securing supplies at reasonable prices for some little time to come.

* * *

Aluminium

Further remarkable progress has been made in the world's production and consumption of aluminium during 1938, a notable feature being the continued expansion in Germany's use of this metal which she favours in place of other non-ferrous metals as it is of home production. Whilst aluminium remains very important in the electrical trades, and may very well become even more so in the future, the principal cause of the expansion during the last year or two has been the world-wide intensive activity in the aircraft industry, which uses such large quantities of light alloys.

One result of the increased output has been that producers were able in July to reduce their price, for the first time for a number of years (from £100 less 2 per cent. to £94 net), thus helping aluminium to maintain its competitive position (due allowance being made for the small tonnages required compared with other metals on a bulk for bulk basis). Productive capacity is being enlarged all over the world, and if and when the present abnormal armament demand subsides producers may be faced with some difficult marketing conditions. For the present, however, supplies are being readily absorbed, especially in alloy form, and producers are looking forward to another good year in 1939

* * *

Zinc

This has been a rather dreary market during the past year. Despite the substantial armament demand for brass, consumption fell materially below production, and prices for most of the year have been at a level unsatisfactory to producers. Tentative negotiations for the re-constitution of the cartel have continued for some time, but at present are awaiting a decision on the application for increased import duties and a direct subsidy from an increased premium on Empire imports, which are the proposals of British and Empire producers now before the Import Duties Advisory Committee.

The galvanising trade has been seriously depressed, and this is one of the main causes of the unsatisfactory conditions. Japan has bought quite heavily during the year, but Germany is becoming increasingly self-sufficient. Zinc ore supplies, which are largely of a by-product nature, have remained plentiful despite unremunerative prices. Unless there is a marked expansion in consumption, or steps are taken for the co-operative control of output, the prospects for the early months of the coming year do not appear very bright.

* * *

Tin

From a consumption point of view 1938 has been a poor year for tin. The American tinplate and motor car industries both had a bad year compared with 1937, and the European tinplate industry has also been depressed. Apart from heavy Russian buying in the early months of the year, there has been no outstanding feature. Quotas under the control scheme, which stood at 70 per cent. at the beginning of the year, had to be further reduced, and by July 1st were down to 35 per cent. for the market, with a special quota of 10 per cent. for the newly formed buffer pool. This pool is to accumulate up to 15,000 tons of tin direct from producers, its objective being to maintain prices between £200 and £230 a ton. So far no tin has been sold from the stocks of the pool, which at present amount to somewhere in the neighbourhood of 8,000 tons, the full 15,000 tons being scheduled for the end of April, 1939.

This pool arrangement has been the main cause of the big rise in prices during the year. Consumption prospects for 1939 are distinctly brighter owing to the improved outlook of the American tinplate and motor car industries, and prices seem likely to be maintained at between £215 and £230 a ton.

* * *

In common with most other commodities the raw rubber market did not have a particularly good year in 1938. Prices

COMMERCIAL AND INDUSTRIAL NEWS

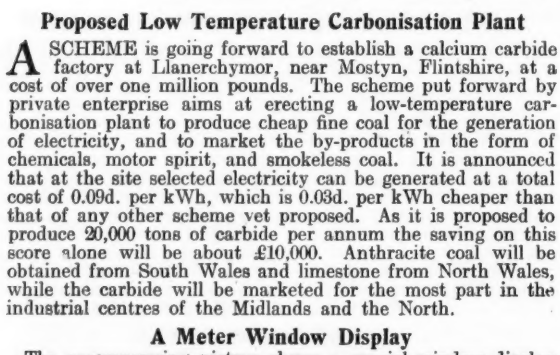
Low Temperature Carbonisation. The Aluminium Industry. Window Display Advertising. An A.R.P. Film. Heating and Ventilating Engineers' New Premises.

Proposed Low Temperature Carbonisation Plant

A SCHEME is going forward to establish a calcium carbide factory at Llanerchymor, near Mostyn, Flintshire, at a cost of over one million pounds. The scheme put forward by private enterprise aims at erecting a low-temperature carbonisation plant to produce cheap fine coal for the generation of electricity, and to market the by-products in the form of chemicals, motor spirit, and smokeless coal. It is announced that at the site selected electricity can be generated at a total cost of 0.09d. per kWh, which is 0.03d. per kWh cheaper than that of any other scheme yet proposed. As it is proposed to produce 20,000 tons of carbide per annum the saving on this score alone will be about £10,000. Anthracite coal will be obtained from South Wales and limestone from North Wales, while the carbide will be marketed for the most part in the industrial centres of the Midlands and the North.

A Meter Window Display

The accompanying picture shows a special window display arranged at the showrooms of the Morley Corporation Electricity Department illustrating the load rate meter. The dis-



A load-rate meter display in the window of the Morley Electricity Department showrooms

play was arranged by Mr. F. J. Libby, of the Metropolitan-Vickers Electrical Co., Ltd., and Mr. N. Hunter, the borough electrical engineer and manager, and its object was to draw the attention of consumers to the special features of this particular meter with a view to encouraging its use. When on the lighting rate (3d. per kWh) the appliances on the left-hand side were lit up, and when it was automatically changed over to the heating rate (1d. per kWh) the appliances on both sides of the display were illuminated. Mr. Hunter informs us that the results have exceeded expectations.

The Aluminium Industry in 1938

A new high level for aluminium production is forecast in a New Year statement issued by the Aluminium Information Bureau. While the output of many industries in this country has declined from the exceptional levels of 1937, the aluminium industry shows a further substantial advance over the 1937 level. Imports of unmanufactured aluminium during the first eleven months of 1938 increased by 64 per cent. from 26,404 long tons to 43,413 tons. A large proportion of the aluminium used in the United Kingdom comes from Canada; the home production was 19,100 long tons in 1937 and may be roughly estimated at 22,500 tons in 1938. The imports of semi-manufactured and manufactured aluminium increased from 35,629 tons in January to November, 1937, to 39,912 tons in the same period of 1938. Exports of aluminium from the United Kingdom, on the other hand, have decreased, indicating pressure of demand for the home market. The exports of unmanufactured aluminium for the eleven-month period were 1,309 tons in 1938 against 3,693 tons in 1937, while exports of semi-manufactured and manufactured aluminium were 4,346 tons in 1938 against 6,116 tons in 1937.

Electrical Materials During 1938 (*Concluded from preceding page*)

Rubber

declined steadily until May, and business was done down to 5⅜d. per lb. On the 31st of that month the International Rubber Regulation Committee fixed the export quota for the third quarter at 45 per cent., compared with 70 per cent. for the first quarter and 60 per cent. in the second quarter, and the third quarter rate remained in force until the end of the year. With this reduction in quotas, stocks began to decrease somewhat, and prices improved until at the end of the year 8¼d. was reached compared with 7 1/16d. a year previously.

The improvement in the American motor car trade was a very important factor in the recovery, and prospects of continued improvement in the United States have encouraged the I.R.R.C. to raise quotas for the first quarter of 1939 to 50 per cent. The control scheme, having at last got stocks down and supplies in relation to demand, should have a fair chance of maintaining prices at a satisfactory level during the coming year, especially as prospects are for consumption improving rather than deteriorating—over the next few months at any rate.

A Women's Pension Scheme

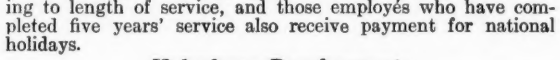
Standard Telephones and Cables, Ltd., has changed its pension plan to provide that its 4,000 women may retire on full pension at any time after the age of fifty, instead of fifty-five, where this would be in their interests. Worked out practically, this means that a girl starting with the company at the age of eighteen and being permitted to retire at the age of fifty would receive a pension equal to nearly half her average pay during the time she has been employed. This pension plan, is non-contributory. It is financed by the company and is applicable to every employé in its service. It has associated with it a non-contributory sickness and accident benefit plan, and male employés have access also to group life insurance at special rates. Another feature of interest in the conditions of employment with the company is that all employés receive annual holidays with pay, up to two weeks in duration, according to length of service, and those employés who have completed five years' service also receive payment for national holidays.

Holophane Developments

Application of scientific illumination to suit modern architecture supplied the keynote of the developments last year of Holophane, Ltd., which reports considerable activity in the production of its recently introduced built-in "Centralene" system of prismatic lenses. This the company claims to be the first lighting unit specifically designed to fit flush into a wall or ceiling while retaining the efficiency of the pendant type, meeting any requirement due to size of building. It is being made for shop windows with a ceiling height of 6 ft. as well as for public buildings where the height is 50 ft. Lens plate is also being used for two new cast-aluminium spotlights, one to take 500 to 2,000-W lamps for stage-work, and the other taking 250 or 500-W projector lamps for commercial displays. A turquoise coloured glass has also been introduced for prismatic reflectors with a view to correcting the spectrum of gasfilled lamps.

New Shop Window Display Advertising

An interesting innovation in display advertising is the system of affixing slogans on shop windows by the silk screen printing process. The device was used for the first time anywhere in the world when it was adopted by the General Elec-



An example of the new G.E.C. silk screen printing process for window slogans

tric Co., Ltd., four months ago. Since then 20,000 G.E.C. slogans, the most familiar being "O for an Osram," have been printed by this method on windows throughout the British Isles. Nearly 100 men, equipped with special portable printing outfits, were engaged in this extensive slogan advertising campaign. The principle of stencilling on glass origin-

ated abroad. A British display expert, touring Europe on holiday this year, saw it used for purposes of political propaganda. He was so impressed with its possibilities for commercial advertising that he brought the idea back to this country. It soon became evident that some adaptation of the process was desirable if it was to achieve complete success. The metal stencil did not permit all letters to be perfectly formed; the "O" looked particularly unsightly, with inevitable gaps at the top and bottom, and it was impossible faithfully to reproduce "Osram" and "G.E.C." in the familiar lettering which constitutes an established trade mark. Efforts to overcome these difficulties resulted in the G.E.C. introducing the silk screen printing process for shop window slogan advertising in place of the original metal stencil. The new method enables the wording to be perfectly formed by a simple operation lasting two minutes. The complete outfit is fitted in a case no larger than an average attaché-case. The process is applied by placing on the window a silk screen which is held taut in a wooden frame. Rubber suckers are fixed to each corner of the frame to hold it to the window glass. The paint is applied with a rubber brush, which is drawn across the silk screen, the latter having been so treated that it will permit the paint to penetrate it only where necessary to give the outline of the required wording. The screen is immediately removed, revealing the slogan on the window. Two slogans used for the initial venture of this method were "O for an Osram," "O for an Osram for your Car" (with each capital "O" formed to represent the headlights of a motor car).

Cosmos Lamp Publicity

The Metropolitan-Vickers Electrical Co., Ltd., has sent us two novelties advertising "Cosmos" lamps. One takes the form of a pack of cards called "Brighter Families," and the game is similar to the well-known family game of "Happy Families," the "families" in this case including "Prof. Cosmos," "Mr. Ivor Longlife," and other names appropriate to the company's lamps. As this is a game in which the whole family can take part, its value as an advertising medium is obvious. The other novelty is a puzzle which consists of two cut-outs of "Cosmos" lamps which, apparently, one has to persuade through a hole of insufficient dimensions.

Ultra-violet Stage Lighting

One of the most spectacular scenes in "These Foolish Things" now running at the London Palladium is a Hawaiian number. It provides an outstanding example of the effects that can be achieved with ultra-violet lighting in the hands of a skilled producer. The scene opens on a Hawaiian beach in brilliant sunshine, with Gerry Fitzgerald and Princess Kuulei, supported by a full chorus of twenty-six Hula girls. Under the full stage lighting the effect is sufficiently striking, but when the normal lighting is blacked out and the whole of the scenery and everybody on the stage appear out of the darkness in brilliant glowing fluorescent colours, the spectacle is very impressive. For this production the normal stage lighting at the Palladium has been augmented by twenty-one 125-W Philips "Philora" black bulb lamps in special mountings devised by the stage electrician so that they can be brought into action easily and quickly. Six special carbon arcs fitted with screens of Wood's glass are also used for spotlighting.

A Cinema Neon Installation

During the past few weeks the canopy at the Bear Street entrance of the Cameo Theatre, Charing Cross Road, has been brilliantly illuminated by Claude-General Neon Lights, Ltd. It was felt that this entrance, being small and situated just off Cranbourne Street, necessitated special treatment in order that it should not be overlooked by the public. "Cleora" hot cathode fluorescent tubes are used to provide the canopy illumination. These tubes, which are 20 mm. in diameter, are operated by a specially designed electrode and run at a higher current than is usual with neon tubes, with the result that the intensity of the tubes is increased to a remarkable degree. Twenty-six parallel lines of this type of tubing are arranged round the face and under the canopy right down to the theatre entrance proper. Three colours, white, sky-blue and peach, are used.

A "Claudgen" neon installation at the Cameo Theatre, Charing Cross Road, London, W.C.2

The average illumination obtained under this canopy at waist-level is 100 ft.-candles. In the theatre entrance the clever use of a mirror over the doors gives the illusion of the tubes extending right into the foyer. The installation, comprising in all approximately 845 ft. of tubing operated by fourteen transformers, is completed by two signs reading "Cameo" on the canopy returns in 12-in. block shaped letters superimposed with a triple-outline of "Claudgen" high-intensity blue tubing and by an interchangeable sign, illuminated by red tubing, under the canopy. The façade lighting, carried out over two years ago in "Cleora" fluorescent tubing of various colours, remains as originally installed.

A Baths Lighting Installation

The Holophane "Built-in" lighting system is based on the power of a prism to control light, and makes use of special prismatic plates built flush into the fabric of a building as a modern style of efficient lighting. The system was designed on a unit principle to enable fittings of various dimensions to be constructed. This unit principle has now been used in a very modern lighting scheme at the new Corporation swimming bath, Wakefield. The lighting scheme of the new bath was by means of three rows of Holophane "Built-in" "Controlens" fittings. These units were mounted flush with the ceiling, thus making a nice clean architectural design of the interior. The centre row comprises fifteen plate units, each equipped with 150-W lamps, whilst the side rows comprise nine lens plates, each equipped with 150-W lamps. The average lighting intensity measured in different places throughout the main bath gives a reading of 17½ ft.-candles. Underneath the gallery of the main bath, there are installed a number of Holophane "Widerlite" bulkhead fittings. This installation is notable for the high intensity lighting on the working plane from units at a height of 35 ft. above water level. The lighting scheme was prepared by the Technical Department of Holophane, Ltd., in conjunction with the Borough Architect's Department, Wakefield, with Mr. H. White, of the Corporation Electricity Department, as consulting electrical engineer. The electrical contractors were H. Smith, of Wakefield.

Holophane "Built-in" lighting at the new Wakefield Baths

Trade Announcements

E. K. Cole, Ltd., announce that Hardy, Tobin & Co., 110, Fenchurch Street, E.C.3, have been appointed selling agents for marine-type "Thermovent" heaters. The "Thermovent" system was devised originally for the staterooms of the *Queen Mary*, and has since been chosen for the *Queen Elizabeth*, the new *Mauretania*, the Admiralty yacht *Enchantress* and many other vessels of recent construction. Up to the present, E. K. Cole, Ltd., have been concentrating on the development of "Thermovents" for general and industrial use. Parallel development is now intended for the marine types, which have been approved by Lloyds and all leading marine insurance companies.

GB Industries, Ltd., have been appointed sole distributors for Great Britain and Ireland for "Marathon" electrical products, including fractional HP motors and grinders. The division marketing these products will be known as Marathon Products, and trade inquiries should be addressed to 39, Clifton Street, Finsbury Square, E.C.2.

Sordoviso, Ltd., makers of non-tilting mercury switches and control gear, has altered its name to Sordoviso Switchgear, Ltd. The company still operates from its head office and works at 220, The Vale, Golders Green, London, N.W.11.

Orel-Micro Electric, Ltd., 39-41, Berners Street, London, W.1, informs us that it has concluded arrangements to handle the "Electro-Boy" clock and combined time switch as agents for this country, and various models are now available.

Cable Repair After Air Raids

Recently the Stoke-on-Trent Electricity Department and City Police A.R.P. Department, in conjunction with the local contracts office of Callender's Cable & Construction Co., Ltd., made a film showing a "fault repair" on high-voltage underground cable "damaged by a bomb." The film is intended for distribution to provincial police forces for instructional purposes. The cable was three-core 0.1 sq. in. p.i., l.s., s.w.a. laid solid in earthenware troughs, a method normally adopted

in the district owing to soil conditions. Prior to the arrival of the jointing squad the hole in the ground had been decontaminated, but full protective clothing was worn as excavation was necessary. A rapid temporary repair was made by cutting back the damaged cable to obtain sound ends and coupling through with single v.i.r. lead-covered tails with cast-iron boxes until such time as a new length of cable with permanent plumbed joints could be inserted. The cores were jointed with "weak-back" ferrules in the usual manner, and prepared paper sleeves were used instead of taping to save time and labour. The use of three single tails instead of a three-core cable meant a quicker job, having regard to the awkwardness of working in full A.R.P. protection, particularly in gloves. It was found that the men could handle three single cables far better than they could trim the paper off a piece of three-core cable. Cast-iron joint boxes were placed in position when jointing was completed, and filled with compound. Such a repair could be carried out by two jointers in about two hours. Time might be still further saved by having the lead-covered tails prepared either before proceeding to the job or by a man, wearing lighter protective clothing, working inside the covered van.

I.E.E. North-Eastern Centre

With the object of assisting the Institution benevolent fund, the North-Eastern Centre of the I.E.E. is holding a dance at Grand Assembly Rooms, Barras Bridge, on January 20th. The dance will be preceded by a dinner. Single tickets for the dinner and dance (12s. 6d. each), will be limited, and applications should reach Mr. G. A. Kysh, assistant secretary, Carliol House, Newcastle-on-Tyne, by January 16th.

E.A.W. Activities

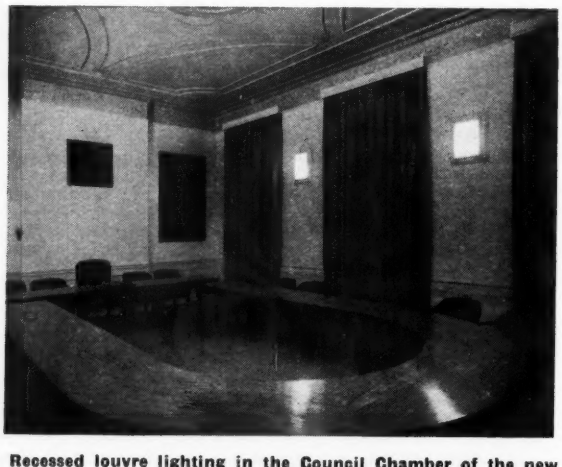
The Croydon Branch of the Electrical Association for Women is running a "Diet and Nutrition Week" at Electric House, 38, High Street, Croydon, from January 16th to 20th.

Manufacturing Activities

In the ELECTRICAL REVIEW for December 23rd a reference appeared in the article on "Manufacturing Activities" (p. 898) to a 60,000-kVA transformer on order for the West Midlands Joint Electricity Authority. This transformer, we are informed by the British Thomson-Houston Co., Ltd., was actually ordered by the Central Electricity Board.

A New Type of Lighting

The use of recessed louvre type fittings to provide the sole source of illumination is a novel feature of the new premises of the Institution of Heating and Ventilating Engineers at 22, Russell Square, W.C.1. The fittings, which are used in both the Council Chamber and the library, consist of multiple parabolic reflectors enclosed in metal boxes recessed into the wall at a height of about 8 ft. 6 in. from the floor, the front of the boxes being finished with slotted wooden mouldings holding sand-blasted champagne-coloured glass louvres sloping upwards. One 300-W lamp is used in each fitting and there are four fittings in each room. The fittings were made by Allom Bros. In the Committee Room one of Osler and Faraday's "Megaphos" units containing a 300-W lamp has been fitted, while the remainder of the fittings installed are of the spherical type, the sizes having been chosen to allow the insertion of the next larger size of lamp in each case should general standards of illumination continue to rise. Partly on the grounds of economy and partly to avoid unnecessary cutting away of old plaster, no attempt has been made to exploit architectural lighting, lighting positions generally having been chosen to maintain an equal balance between ease of wiring and

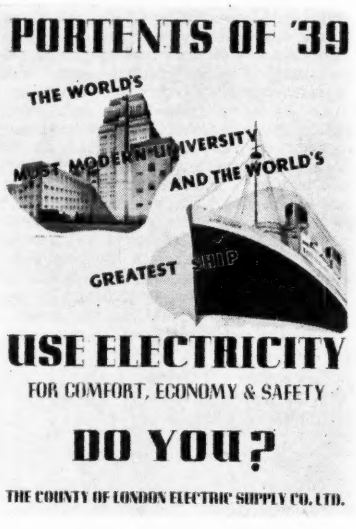


Recessed louvre lighting in the Council Chamber of the new premises of the Institution of Heating and Ventilating Engineers [*Elec. Rev. photo.*

good effect, with good distribution of light as the necessary condition. Temperature control of the hot-water radiator installation is carried out by means of "Satchwell" thermostats in conjunction with magnetic valves, the oil-fired boiler itself also being fitted with a thermostatic control system (Thermocontrol Installation Co.), which embodies a Venner time switch to change over from night to day temperatures and *vice versa*. Mechanical ventilation of the Council Chamber and the Meeting Room is effected by electrically operated fans. The fans can be run at different speeds in summer or winter.

London Electrical Publicity

The County of London Electric Supply Co., Ltd., is constantly producing new advertisements to catch the eye of prospective consumers in its area, and in the accompanying illustration we show the clever use made of two outstanding engineering achievements in this country in which electrical services are a prominent feature. It will be seen that after pointing out that the University of London and the *Queen Elizabeth*, use electricity for comfort, economy and safety, the advertisement concludes on a note of interrogation.



The Christmas advertisement of the County of London Co.

Prices of Materials

The following prices are only general, and they may vary according to quantities and other circumstances:—

CHEMICALS, ETC.	Price January 4th.	Fortnight's inc. or dec.
a Acid Oxalic ... ... per cwt.	50s.	—
a Ammoniac, Sal ... ... per ton	£37	—
a Ammonia, Muriate (large crystal)... ,,	£18 10s.	—
a Borax... ... ... ,,	£17	—
a Copper, Sulphate ... ... ,,	£19	—
a Potash, Chlorate ... ... per lb.	3½d. to 4½d.	—
a ,, Perchlorate ... ... ,,	6d.	—
a Shellac ... ... per cwt.	£4 8s.	—
a Sulphur, Commercial ... ... per ton	£11	—
a ,, Roll ... ... ,,	£11	—
a Soda, Chlorate ... ... per lb.	3½d. to 3¾d.	—
a ,, Crystals ... ... per ton	£5 to £5 5s.	—
a Sodium, Bichromate, casks ... per lb.	4¼d. net.	—
METALS, ETC.		
b Aluminium, Ingots ... ... per ton	£94	—
b ,, Wire ... ... per lb.	1/1 to 1/9	—
b ,, Sheet and Foil ... ,,	1/2½ to 2/9	—
p Babbits Metal and Anti-friction Metals—		
Grade I ... ... per ton net	£199	—
Grade II ... ... ,,	£139	—
Grade III ... ... ,,	£75	—
c Brass (rolled metal 2" to 12" basis)... per lb.	8¼d.	½d. inc.
c ,, Tubes (solid drawn) ... ... ,,	11½d. to 11¾d.	—
c ,, Wire, basis ... ... ,,	8¾d.	½d. inc.
c Copper Tubes (solid drawn) ... ,,	1/0½d.	—
g ,, Bars (best selected) ... per ton	£80	—
g ,, Sheet ... ... ,,		—
g ,, Rod ... ... ,,		—
d ,, (Electrolytic) Bars ... ,,	£50 15s.	£1 5s. inc.
d ,, ,, Wire Rods ... ,,	£55 10s.	£1 5s. inc.
d ,, ,, H.C. Wire ... per lb.	7½d.	½d. inc.
f Ebonite Rod ¼" dia. & up. ... ,,	1/10 to 2/5	—
f ,, Sheet ⅛" thick & up ... ,,	1/5 to 1/10	—
n German Silver Wire, Nos. 1 to 12... ,,	2/4	—
h Gutta-percha, fine ... ... ,,	Nom.	—
h India-rubber, Para-fine ... ... ,,	7d.	½d. dec.
i Iron, Pig (Cleveland, No. 3) ... per ton	£4 5s.	—
i ,, Wire galv. No. 1 P.O. Qual. ... ,,	£23	—
g Lead, English Pig ... ... ,,	£17	5s. inc.
g Mercury ... ... per bot.	£15	5s. inc.
e Mica (in original cases) small ... per lb.	10d. to 2/–	—
e ,, ,, ,, medium ... ,,	6/– to 12/6	—
e ,, ,, ,, large ... ,,	13/– to 17/6 up	—
p Phosphor Bronze, plain castings ... ,,	1/2½	—
p ,, ,, drawn bars & rods ,,	1/1½d.	½d. inc.
p ,, ,, rolled strip & sheet ,,	11½d.	½d. inc.
p ,, ,, wire ... ... ,,	1/1½d.	½d. inc.
o Platinum ... ... per oz.	£7 10s.	—
d Silicum Bronze Wire ... ... per lb.	8½d.	—
g Spelter ... ... per ton	£13 13s. 9d.	2s. 6d. inc.
g Tin, Block (English) ... ... ,,	£217 5s.	£3 inc.
n ,, Wire, Nos. 1 to 16 ... ... per lb.	3/6	—

Quotations supplied by:—

a G. Boor & Co.
b The British Aluminium Co., Ltd.
c Thos. Bolton & Sons, Ltd.
d Frederick Smith & Co.
e F. Wiggins & Sons.
India Rubber, Gutta Percha and Telegraph Works Co., Ltd.
g Henry Gardner & Co., Ltd.
h Edward Till & Co.
i Bolling & Lowe.
n P. Ormiston & Sons.
o Johnson Matthey & Co.
p C. Clifford & Sons, Ltd.

The above table is published here fortnightly. In alternate issues, in which it does not appear, the latest prices of copper, silicium bronze wire, lead, rubber, tin and spelter, up to the time of going to press, are given in this section under the same heading.

E.D.A. Diplomas

At the third examinations for the E.D.A. salesmanship certificate held in November-December, 133 students took the final examination and 101 passed, eight of them with distinction. The Garcke prize for 1938, awarded annually to the student obtaining the highest marks during the year, will be divided between Mr. J. R. E. G. Allen (Central London Electricity), and Miss P. Gidley (Grimsby). Ten further sales engineers' diplomas have been awarded and thirteen domestic electrical salesmanship diplomas.

L.S.E. Production Activity

Orders in hand at the turn of the year indicate that the activity displayed during 1938 in the various works of Laurence, Scott & Electromotors, Ltd, is being fully maintained. The additional manufacturing equipment installed in 1937 is now in full production and has facilitated the introduction of new features such as die-cast rotors for the smaller squirrel-cage motors and a new process for impregnating windings. New designs of auto-synchronous motors are under construction, having a new type of winding that simplifies starting and cable work and improves performance. Other introductions are a new range of variable-speed AC commutator motors, a high-torque squirrel-cage machine, several additional sizes of AC and DC flameproof motors, a semi-mill type DC machine for exacting industrial duties and motors with special characteristics for air-raid syrens. Marine electrical plant (including the Scott winch) still keeps L.S.E. busy, even though the 20,000 HP for the *Queen Elizabeth* and the other large order for the new *Mauretania* have been completed. There is also a large number of motors under way for power station auxiliaries, both home and overseas; these are designed for direct starting and most of them are of the "Emcol" type with improved cooling arrangements. The K.S. welding generator in its various sizes and motors for lifts and cranes are evidently in good demand. Export business is being well maintained, chiefly for large machines; notable examples are provided by two 1,600-HP hypo-synchronous motors for the Rand Water Board and smaller units for gold mining dredging and marine work.

E.R.A. Meeting and Luncheon

The annual luncheon of the British Electrical & Allied Industries Research Association is to be held on February 10th at the Savoy Hotel. The luncheon will be preceded by the annual general meeting.

Calendars, Diaries, etc.

The neat calendar of the Hotpoint Electric Appliance Co., Ltd., has a picture entitled "Glowing Warmth," showing a mother and her child enjoying the comforting warmth of an electric fire. The monthly sheets also show the preceding and following months.

Millais' famous picture "The Boyhood of Raleigh" has been chosen by the West of England Electric Instruments, Ltd., and associated companies for their calendar, which has monthly slips.

Landis and Gyr, Ltd., have sent us a refill for their desk calendar.

The diary received from Erskine Heap & Co., Ltd., is bound in dark blue morocco and in addition to the usual diary information contains useful data relating to cables and conductors. There are also sectionalised maps of Great Britain.

Mr. Geo. Barnard has sent us a refill for his desk calendar, and also a neat diary in dark brown leatherette.

The Portable Furnace & Patents Co. has again sent us a useful engagement calendar with one month to each sheet at the back of which is a calendar for the year.

The calendar of Austin Walters & Son, Ltd., has large monthly sheets mounted on a card with a view of the company's works. Each sheet shows the preceding month and the following three months.

The block calendar of D. Gilson & Co., Ltd., is mounted on a cut-out of a screw in black and gold.

The block calendar of the Davenport Engineering Co., Ltd., is mounted on a strong board on which is a drawing of three water cooling towers.

B. S. & W. Whiteley, Ltd., have again sent us a neat desk calendar with daily tear-off slips bearing quotations.

Fitter & Poulton, Ltd., have sent us an artistic calendar with an old-world picture beautifully coloured entitled "The Amateur Gardener." The monthly slips also show the preceding and following months.

The calendar of Pope's Electric Lamp Co., Ltd., has large monthly tear-off sheets with bold figuring, mounted on a card drawing attention to "Elasta" lamps.

Litholite Insulators and St. Albans Mouldings, Ltd., have sent us an engagement pad with one week to a page.

The calendar received from the Revo Electric Co., Ltd., has large daily tear-off slips mounted on a card illustrating the company's Tipton works.

A Highland laddie setting out on a journey with his dog makes an attractive picture for the calendar received from Brittain's (formerly Langdon-Davies) Electric Motor Co.

The calendar of Adamson & Co. (Tyne), Ltd., has large daily slips with bold red figures.

"Dolores," a seductive brunette, adorns the calendar of the Supra Electrical Co., Ltd.

A useful engagement calendar has been received from Thomas R. Hills, Ltd.

Londex, Ltd., has sent us examples of a handy memorandum pad.

New Catalogues and Lists

Blackwell's Metallurgical Works, Ltd., Speke Road Works, Garston, Liverpool, 19.—A list of metals, alloys and specialities.

Davidson & Co., Ltd., Sirocco Engineering Works, Belfast, Northern Ireland.—A leaflet dealing with "Aeroto" screw fans for ventilating mines and collieries.

Falk, Stadelmann & Co., Ltd., 83/93, Farringdon Road, London, E.C.1.—A 52-page illustrated catalogue of switch and fuse gear.

Liverpool Electric Cable Co., Ltd., Linacre Lane, Bootle, Liverpool, 20.—Details of the new "Lecuplu" flameproof sealing and coupling box.

Siemens & General Electric Railway Signal Co., Ltd., Central House, Kingsway, London, W.C.2.—A leaflet giving details of searchlight signals.

Michael Black, Ltd., 138, West George Street, Glasgow, C.2.—A 71-page catalogue of radio and domestic appliances.

Clifford & Snell, Ltd., Carshalton Road West, Sutton.—Details of a range of heavy-duty "Londaphone" telephones, the "Ordasign" and "Synchro-dial" transmitter.

Company Liquidations

D. C. Electric Co., Ltd., Sherborne, Dorset.—The statutory meeting of creditors was held recently at Sherborne, when it was stated that the assets totalled £930, and they were subject to preferential claims of £89, leaving a balance of £891 to meet claims on debentures of £2,685. There was a deficiency so far as the debenture holder was concerned of £1,794, and there were no assets available for the unsecured creditors. The issued capital of the company was £2,850, and as regarded the shareholders there was a deficiency of £6,886. On November 30th last the debenture holder appointed Mr. F. V. Redman, accountant, of Swanage, as receiver, and that gentleman had since continued the business. It was decided that the voluntary liquidation of the company should be continued with Mr. Redman as liquidator.

Princely Products, Ltd., 37, Bedford Row, W.C., radio and electrical dealers.—The first meetings of creditors and shareholders under the compulsory liquidation of this company were held on December 23rd at the Board of Trade Offices, Carey Street, W.C., before Mr. C. W. Bird, Official Receiver. The company was formed in July, 1937, by Shri Paul Chanders Jaina with a capital of £150 to carry on business in England and elsewhere as motor, radio and electrical dealers. Mr. Jaina states that until March, 1937, he was employed on the sales staff of a wireless dealer and then started on his own account under the style of Princely Products as a supplier of radio sets. The company did not take over his business and had no working capital. The business was not very extensive and no trade had been done since July last. The company was short of liquid capital throughout; creditors began to press last March and eventually one of the number obtained the winding-up order. So far as the Official Receiver was at present aware, the only available assets of the company comprised two electrical testing machines and a book debt, together expected to realise approximately £85. The liabilities to unsecured creditors were approximately £1,326. Jaina attributes the failure to the general lack of demand for car radio sets and to lack of capital. The liquidation was left in the hands of the Official Receiver.

Bankruptcy Proceedings

G. Hopkinson, 84, Derby Road, Chesterfield, radio engineer and wireless dealer.—The public examination of this debtor was held recently at the County Police Court, Brimington Road, Chesterfield, when the statement of affairs disclosed a deficiency of £475. The debtor attributed his failure to lack of capital having regard to the large amount of hire-purchase business done, heavy losses sustained through the repossession of sets from defaulting customers under hire-purchase agreements, competition and heavy expenditure of free servicing of sets sold. The examination was closed.

R. G. Littlewood, trading as Littlewoods, 19, Burnt Ash Road, Lee Green, S.E.12, radio specialist.—This debtor attended at the Court House, Burney Street, Greenwich, recently, for his public examination, his statement of affairs showing a deficiency of £1,485. Debtor ascribed his failure to insufficient working capital and inability to dispose of the business as a going concern. The examination was adjourned for closing.

A. H. Estall, electrical contractor, 20, Thackeray Street, Kensington, W.8.—Last day for receiving proofs for dividend January 13th. Trustee, Mr. W. A. J. Osborne, Balfour House, Finsbury Pavement, E.C.2.

INFORMATION DEPARTMENT

GENERAL inquiries from readers relating to sources of electrical goods, makers' addresses, &c., are replied to by our Information Department through the post. Inquiries should be accompanied by a stamped addressed envelope.

Our extensive records enable us to reply to most queries, but occasionally we ask for our readers' assistance in tracing names and addresses not known to us. We should be glad to have such information regarding the following:—

RABALDO electric shaver.
FLASH HEAT OR FLASHEET teapot and mug unit.
BUTTER KNIFE, Electric.
FRAGRANTAIR fan heater.

ELECTRICITY SUPPLY

Inverness Petition for Local Generation. Lower Charges at Liverpool. Manchester and Coal Cost. Large Turbines for American Water Power Scheme

Aberystwyth.—OVERHEAD LINE.—The Corporation is to construct an overhead line from Pendre Railway Bridge to Penydibyn.

Barnsley.—ELECTRICITY FOR MARKETS.—The expenditure of £2,000 to provide electricity for lighting and power purposes for stalls and roundabouts on Markets Committee lands has been approved by the Finance Committee.

Bedford.—FUTURE EXPENDITURE.—Provision is made for the expenditure of £363,275 during the next five years in connection with electricity supply, the respective sums for each of the five years being: £72,000, £83,275, £70,000, £70,000 and £68,000.

Bexhill.—CENTRAL SWITCHING SYSTEM.—The borough electrical engineer has been authorised to obtain an estimate of the cost of a system of centralised switching control of A.R.P. signals, street lighting, &c.

Blackburn.—LIGHTING.—The Town Council has approved a scheme costing £24,000 for bringing the lighting of certain roads up to the standard advocated by the Ministry of Transport.

SUPPLY EXTENSION.—A supply of electricity is to be given to Rose Hill Mill at a cost of £1,066.

Blaydon-on-Tyne.—STREET LIGHTING.—The Urban District Council is to enter into an agreement with the North-Eastern Electric Supply Co., Ltd., for electric street lighting, following the announcement that Priestman's Collieries, Ltd., who have hitherto been the suppliers, are withdrawing from the contract.

UNDERGROUND MAINS.—The Urban District Council has approved plans by the North-Eastern Electric Supply Co., Ltd., for laying underground low-voltage cables at Mundle Avenue, Winlaton Mill and in Western Way, Axwell Park, Blaydon.

Brandon (Suffolk).—STREET LIGHTING TO BE ELECTRIC.—Provided that a slight extension of the lighting area is agreed to by the electricity company, the streets will be lighted by electricity instead of gas from April 1st next.

Bognor Regis.—EXTENSIONS.—An 11-kV overhead line, 2½ miles long, and about ½ mile of underground cable, have just been completed to Dale Park and Madehurst, and 30-kW pole transformers have been fixed at each large house. The supply was taken from the Bognor Gas and Electricity Company's outdoor sub-station at Slindon.

Chester.—POWER STATION EXTENSION.—The Electricity Committee has considered a report by Mr. S. E. Britton, the city electrical engineer, upon the proposed extension of the Queen's Ferry power station, and application is to be made for consent to the extension of the power station and to the borrowing of £397,280.

Chester-le-Street.—COMPANY TO SUPPLY ESTATE.—The Urban District Council has reached an agreement with the North-Eastern Electric Supply Co., Ltd., for the taking over of the Council's electricity undertaking on the Bullion Lane estate as from April 1st next.

Coventry.—SUPPLY TO ANSTEY.—The Town Council is to extend mains to Anstey at a cost of £2,000.

Epsom and Ewell.—VOLTAGE FLUCTUATIONS.—To remedy voltage fluctuations in the Eastway district the Electricity Committee has recommended that additional plant should be installed and that application should be made to borrow £4,075 for the purpose.

Erpingham (Norfolk).—RURAL SUPPLIES.—The East Anglian Electric Supply Co., Ltd., is to provide a supply to many villages in the area of the Rural District Council during 1939.

Essex.—POWER PLANT FOR HOSPITAL.—The Health Committee is to purchase a 200-kW high-speed steam generating set at an estimated cost of £3,000 for the Severalls Mental Hospital.

Eston.—UNDERGROUND CABLES.—Sanction is being sought by the Electricity Committee to borrow £2,806 for the replacement of the existing overhead lines by underground cables upon the widening of Normanby Road. A loan of £500 is also required for wiring installations.

Failsworth.—GRANT TOWARDS IMPROVED LIGHTING.—At a Council meeting it was reported that with regard to the lighting of Oldham Road by electricity the Minister of Transport would be prepared to consider making a grant of half the difference in cost between the existing lighting and a scheme of lighting as approved by the Ministry.

Falkirk.—ELECTRIC HEATING ON TRIAL.—The Cleansing Committee recommends that a two months' trial be given to a new electric heating system at the refuse disposal works.

Faversham.—OVERHEAD LINES.—The Town Council is raising no objection to the construction of low-voltage overhead lines at Boughton by the Kent Electric Power Co.

Finchley.—RECTIFIER TRANSFORMER BREAKDOWN.—At a recent meeting of the Electricity Committee the general manager reported that a 150-kW rectifier bank had tripped out due to the breakdown of the rectifier transformer. An examination of the transformer had revealed that the fault was not so serious as was at first suspected, but the incident illustrated the risk which attended the policy of not increasing the DC plant capacity.

Glasgow.—NEW SUB-STATIONS.—Plans have been passed for a sub-station, compressor house, screening chamber, &c., at Bothwell Bridge, and three other sub-stations in the town in connection with the Corporation's big sewage works scheme.

ELECTRIC CLOCKS.—The Police Committee has decided to have electric clocks installed in the northern police office by the Electricity Department at an estimated cost of £70.

ILLUMINATIONS IN PARKS.—The Parks Committee has agreed to continue consideration of a report by the inspector of lighting suggesting the installation of illuminated decorations and decorative lighting in the city parks.

Gosport.—ELECTRIC LIGHTING PREFERRED.—Following experimental lighting in two portions of Forton Road by the Portsmouth electricity undertaking and the Portsmouth and Gosport Gas Company, six months' notice is being given to the Gas Company by the Borough Council to terminate its contract as from June 30th, 1939.

Guildford.—STREET LIGHTING.—The Highways Committee is to improve street lighting at a cost of £490.

Ilford.—LOANS.—The Electricity Committee is seeking sanction to borrow £10,000 for wiring installations and £2,634 for a sub-station in Mossford Lane.

Inverness.—PETITION FOR LOCAL GENERATION.—Five thousand signatures have been attached to the petition which is being sent to the Secretary of State for Scotland by the people of Inverness protesting against the refusal of the Electricity Commissioners to permit the Town Council to extend the plant at the municipal electricity undertaking to meet local requirements.

Kettering.—MAINS AND SERVICES.—Sanction is being sought by the Urban District Council to a loan of £65,000 for mains and services.

Lancaster.—ELECTRICITY AT GALGATE.—The Rural District Council proposes to have electricity installed in houses at Galgate.

Leicester.—PRECIPITATOR PLANT.—The Electricity Committee has decided to install an electrostatic precipitator plant, costing £32,000, at the generation station.

Liverpool.—LOWER CHARGES.—Domestic consumers will benefit to the extent of £24,500 per annum and other consumers by £18,500 by lower electricity charges which came into operation on January 1st. Hirers of electric cookers who use the same cooker regularly for three years become eligible, in approved cases, for a reduction of 20 per cent. in the rental, and subject to a continuance of those conditions for three years a further reduction of 10 per cent. at the sixth year. Where users of cookers also have electric washboilers, hired at 2s. 6d. per quarter, the rental of the washboiler will be reduced to 1s. 6d. per quarter. The present fixed charge of 1s. 2d. per week and ½d. per kWh to tenants on the Corporation estates are reduced to a fixed charge of 1s. per week, with the same "unit" charge. There is a new tariff for hired apparatus enabling the consumer to rent a cooker and washboiler for a commuted sum of 4d. per week to be added to the fixed charge of 1s. per week.

Manchester.—COST OF COAL.—When the Electricity Committee recently had under consideration tenders for the supply of coal for 1939 concern was expressed at the continued rise in price. It was stated that the pithead prices which would have to be paid represented increases of as much as 50 per cent. over those in 1935, when the new marketing scheme came into being in Lancashire. The Committee is seeking advice on the question of an appeal to the Committee of Investigation. Under the new procedure the hearing can be in public.

ELECTRICITY FOR COUNCIL HOUSES.—The director of housing is to arrange for the installation of electric lighting and power at the Chester Street dwellings, the cost to be recovered by an additional weekly charge of 2d. on the rent.

Milford Haven.—LOANS.—Sanction is being sought by the Electricity Committee to loans of £1,000 for meters, £2,000 for consumers' apparatus and £2,000 for mains and services.

Mirfield.—MAINS EXTENSIONS.—Sanction is being sought by the Urban District Council to a loan of £10,000 for mains extensions.

Morecambe.—HIGH-VOLTAGE DEVELOPMENTS.—The Electricity Committee is to develop the extra-high-voltage system in the centre of the town at a cost of £9,355.

ILLUMINATIONS.—Three alternative illumination schemes are being prepared by the electrical engineer for consideration by the Illuminations Committee.

Oldham.—HIRE CHARGES UNDER CONSIDERATION.—Complaints have been made regarding the charge for hiring reconditioned cookers which are higher than those for gas cookers. The electrical engineer, Mr. F. L. Ogden, is to investigate the matter.

Peterborough.—STREET LIGHTING.—A scheme for lighting the Eye Road from Newark to the city boundary with twenty-three sodium lamps, at a cost of £620, is receiving consideration.

METERS.—Application is to be made for permission to borrow a further £5,000 for the purchase of meters.

Ploughley.—APPLICATION FOR ELECTRICITY.—The Electricity Committee has recommended the Rural District Council to support an application by twenty-eight householders in Thrupp for a supply of electricity by the Wessex Electricity Co.

Pontardawe. — PROFITABLE UNDERTAKING. — Despite a big reduction in tariffs the electrical engineer and manager reports a net profit of at least £2,000 on the year's working. Under the assisted-wiring scheme more than 2,000 installations have been made and the reduction to consumers by way of reduced tariffs has amounted to £3,500. When the reserve fund reaches the maximum allowable figure under the Act, Mr. R. M. Jenkins, the engineer, urges that a fixed standing charge of 10s. per quarter be made irrespective of size of house, and a fixed standing charge of £1 per quarter for all business premises, with a running charge of ¾d. per kWh.

Portland.—TEMPORARY HIGH-VOLTAGE SUPPLY.—The electrical engineer recently reported that he had received an application from a firm of contractors for a high-voltage supply for a period of approximately three years. The demand would be approximately 250 kW and the estimated annual consumption 400,000 kWh. It would be necessary to lay a high-voltage cable from the Tillycombe sub-station, finishing by overhead lines, and the cost of carrying out this work would be approximately £700. It was agreed that the contractors should be offered a supply at £4 10s. per kW of demand per annum, with electricity at 0.35d. per kWh, subject to coal and other clauses.

Preston.—ELECTRICAL DEVELOPMENTS.—The Town Council has authorised the immediate commencement of the first part of a scheme (costing £30,000) for the erection of two sub-stations near the Ribble power station, and a third sub-station in Crown Street, to provide a standby supply to cope with increasing demands and to ensure an emergency supply in the event of air raids. The full scheme will cost £70,000, and is part of the Corporation's five-year programme. Ald. H. E. Rhodes, chairman of the Electricity Committee, said the growth of demand upon the Ribble station had exceeded all expectations, and the existing 6,600-V cables might become overloaded. Already the English Electric Co. had applied for an additional 2,000 to 3,000 kW of power, and the Fylde Water Board anticipated electrical developments at the Docks. The Home Office had also stressed the need for a standby supply, urging that if for any reason arising out of air raids the power station was put out of action, there must be a standby system to keep factories and workshops going.

Scunthorpe (Lincs).—MAINS.—Owing to the difficulty of maintaining the pressure of the supply in the Spencer Avenue area the distribution is to be augmented by replacing the existing single-phase mains by three-phase lines at a cost of £135.

Sheffield. — ELECTRICITY FOR HOSPITAL. — The Electricity Department has been requested by the Health Committee to install electricity at the Intake maternity centre at an estimated cost of £568.

Stafford.—WASH BOILERS.—The Town Council proposes to have electric wash boilers installed in new houses on the Silkmore Estate. Mains are to be extended from Lammascote Road to Market Square.

Stoke-on-Trent.—MAINS EXTENSIONS.—The Electricity Committee is to extend mains at a cost of £450 to provide an additional supply to C. Woolliscroft & Sons, Ltd., at the Canal Tileries, Etruria, Hanley.

TRANSFORMERS.—The transformer capacity at Bath Street sub-station, Tunstall, is to be increased at a cost of £550.

SUPPLY IMPROVEMENTS.—A sum of £750 is to be spent on improvements in the York Street clearance area, Hanley, and an additional supply is to be given to the works of the Oldfield Brick & Marl Co., Ltd., in Duke Street, Fenton, at a cost of £900. A supply is also to be given to the Danilo Cinema, Hill Street, at a cost of £520.

BULK SUPPLY.—Negotiations are to be carried out by the electrical engineer with the borough electrical engineer of Newcastle-under-Lyme in respect of a supply to the Bradwell Hall Tileries, Wolstanton, a bulk supply being desired by the Newcastle Corporation at the boundary of the Wolstanton area.

Stromness.—PUBLIC LIGHTING.—The Town Council is considering a scheme of electric lighting for the town.

Sutton Coldfield.—NEW CABLE.—The Electricity Committee is to lay a new cable in Birmingham Road at an estimated cost of £854.

Thingoe.—RURAL SUPPLIES.—At a meeting of the Rural District Council the clerk was instructed to approach the Ministry of Health asking that the East Anglian Electric Supply Co., Ltd., should be urged to make a supply of electricity available to all the parishes in the district.

Thornton Cleveleys.—LOAN FOR APPLIANCES.—Sanction is being sought by the Urban District Council to a loan of £5,000 for electrical appliances.

Tiverton.—ELECTRIC STREET LIGHTING.—The Town Council proposes to illuminate the main streets by electricity, at an estimated cost of £1,125.

Tottington.—ELECTRIC STREET LIGHTING CONSIDERED.—The Urban District Council is considering lighting the main and secondary roads with 100-W lamps.

Walsall.—SUB-STATIONS.—The Electric Supply Department is to construct sub-stations in Harden Road and Abbotts Street, Walsall.

Whitworth.—BULK SUPPLY AGREEMENT TO BE TERMINATED.—The Council has given notice to the Rochdale Corporation to terminate its bulk-supply agreement in 1940.

Wrexham.—SUPPLY EXTENSION.—The Electricity Distribution of North Wales, Ltd., proposes to supply electricity to Allington and Trevalyn.

York.—BETTER LIGHTING.—The Highways Committee is to improve the lighting in Walmgate at a cost of £439.

Overseas

Czechoslovakia.—MORAVIAN ELECTRIFICATION PROBLEMS.—A meeting of the heads of the three Moravian electricity works has decided on the union of the three concerns, grouping what is left of the Nordmahrische with the Mittlemahrische and the Westmahrische works. The problem became acute after the cession of territories to Germany and Poland, as the output of the North Moravian company was reduced to a third of the original quantity. The combined companies intend to set up a plan to intensify the development of electricity in the whole of Moravia along homogeneous lines. About 400 villages in the country remain to be supplied.

France.—INCREASE IN ELECTRICITY PRODUCTION.—The production figures of the Ministry of Public Works for the first nine months of this year show that there has been a steady improvement, the total output rising by 6.7 per cent. to 9,802 million kWh.

India.—ELECTRIFICATION IN BIHAR.—The Government has decided to undertake the scheme for the electrification of Bihar province as prepared by its special officer and approved by a committee of experts, and the Finance Minister has been asked to provide funds to begin the construction and engage the staff for the purpose. According to the scheme now adopted the central generating station will be near Dhanbad, where water is obtainable in adequate quantities from the Damodar River. The initial capacity of the station will be 30,000 kW, which will be raised to 50,000 kW. The launching of a complete scheme for South Bihar is favoured, with two main double distribution lines. The question of the supply of power for North Bihar is considered difficult and costly in view of the distance from the power station. The cost of the scheme has not yet been fully ascertained.

United States.—TURBINES FOR GRAND COULEE SCHEME.—Three 150,000-HP turbines have been ordered by the Secretary of the Interior for the Grand Coulee Dam power plant, states the *Electrical World*. Contracts have been awarded for the three vertical-shaft hydraulic turbines in the left power-house and for three oil-pressure, actuator-type governors, with pumping equipment, for regulating the speed of the turbines. The initial power development will include the completion of the left power house and the installation of the three main generating units and two station-service generating units, and will include also the construction of the foundation for the right power house. It is expected that the first unit will go into operation in January, 1942.

Yugoslavia.—HYDRO-ELECTRIC SCHEME.—According to the *Balkan Herald*, preliminary work on a hydro-electric power project on the River Drina, in Bosnia, will be completed by March, and the main works will be put in hand in the coming summer.

Western Australia.—OPENING OF NEW POWER STATION.—The new "B" station of the Government Electricity Supply Department at East Perth, a photograph of which was published in the ELECTRICAL REVIEW of December 16th, is to be formally opened on January 20th. The ceremony will be performed at a luncheon at Australia House, London, from where the Duke of Devonshire, Under-Secretary of State for Dominion Affairs, will speak by radio-telephone to Australia. The guests at the luncheon, which is to be given by the Agent General (Sir Hal Colebatch) on behalf of the Western Australia Government, will be shown a film illustrating the construction of the station.

A National Reserve of Electrical Plant

AS a result of discussions with representatives of public utility undertakings the Ministry of Transport has announced its decision that a national reserve of switchgear, transformers and incidental equipment shall be formed at suitable centres to be readily available for installation where required under the administration of the Central Electricity Board. The cost of these measures (and certain other steps for the protection of plant outside the scope of ordinary "good employer" air-raid precautions) has been estimated at £3,000,000. Parliament will be asked to undertake the liability for one-half of this total (*i.e.*, for £1,500,000) and to authorise the remaining half to be borrowed by the Central Electricity Board; interest, sinking fund and other necessary charges being met by means of a levy upon authorised undertakings, on the lines of the levy for standardisation of frequency.

TRACTION

Ipswich.—TROLLEY-BUSES.—The Transport Committee is to extend the trolley vehicle system to the Priory Heath estate, at a cost of £3,800.

Italy.—RAILWAY ELECTRIFICATION.—According to the *Corriere della Sera*, the electrification of the Basle-Milan railway line will be completed some time this month, as the Chiasso-Milan section will by then be equipped. When this last section is ready Italy will possess 3,125 miles of electric railways. It is planned to electrify a further 1,250 miles of lines that run into Milan.

London Transport.—NEW STATION OPENED.—The reconstructed tube station on the Central London line at St. Paul's was opened on Tuesday. Two banks of escalators have been built to replace the existing lifts.

Northern Ireland.—TROLLEY-BUSES TO TAKE PLACE OF TRAMS.—On Monday the Belfast City Council decided that trolley-buses should be gradually introduced in place of the tramways. In the East district, which will be dealt with first, the cost of the trolley-buses will be £518,000, but this will be substantially less than the amount that would have to be spent on relaying the tram track and renewing the overhead equipment. During the past nine months an experimental trolley-bus service has been operated in Falls Road and has shown that this method of transport greatly assists in relieving traffic congestion.

Smethwick.—PURCHASE OF TRAMWAYS.—The Corporation recommends that the purchase price of £49,971 for the Smethwick portion of the tramway undertaking should be approved.

Russia.—THE MOSCOW UNDERGROUND.—About half a kilometre of the third section of the Moscow underground railway has now been tunnelled, reports *Reuter's Trade Service*. The tunnel rings are being installed and the ferro-concrete work begun. According to the plan the tunnelling is to proceed much more quickly than on the second section; whereas the distance bored in 24 hours was formerly 2.6 m. it is now to be 3.6 m. The technical plan has been submitted for confirmation by the Soviet Council of Commissars. The proposed Pokrovsky line is to be 8.3 km. instead of 7.3 km. long as originally planned and seven stations are to be built instead of six, the extra one being at Semionov Square. All the stations of the third section will have escalators. The width of the Stalin Stadium station, the largest on the third section, is 35 m. and the length 160 m. The construction is much more complicated than that of the first and second sections, as the tunnels have twice to pass under the River Moscow.

COMMUNICATIONS

Germany.—DIRECT TELEPHONE CONNECTION BETWEEN BERLIN AND ATHENS.—A direct telephone line between Berlin and Athens has recently been completed and put into service. The line has a total length of approximately 1,900 miles and is the longest direct telephone connection at present available through the Berlin trunk exchange. The line is laid as a trunk cable through Germany from Berlin to the frontier town of Wildon, whence it continues as open-wire lines through Yugoslavia and Greece until it reaches Athens. In the open-wire sections the connection is effected on the Siemens and Halske carrier frequency system, which renders multiple utilisation of the lines possible.

Great Britain.—GLASGOW'S AUTOMATIC TELEPHONES.—The Post Office is making rapid progress with the scheme for the complete installation of automatic telephones in the Glasgow area involving a total expenditure of more than £1,000,000. Automatic telephone exchanges are to be built in the Bridgeton and Ibrox districts and the Office of Works is inviting tenders for the work. It is hoped to have the scheme completed within two years.

LONG-DISTANCE TELEVISION RECEPTION.—The B.B.C. announced on Monday that television transmissions from the Alexandra Palace had been picked up in New York. The pictures were seen on one of the television sets of the Radio Corporation of America at the Riverhead station, but such reception must be regarded as freakish and only possible under exceptionally favourable atmospheric conditions. On the day that the pictures were seen the accompanying sound could not be heard, but six days later when the sound was heard the pictures could not be seen.

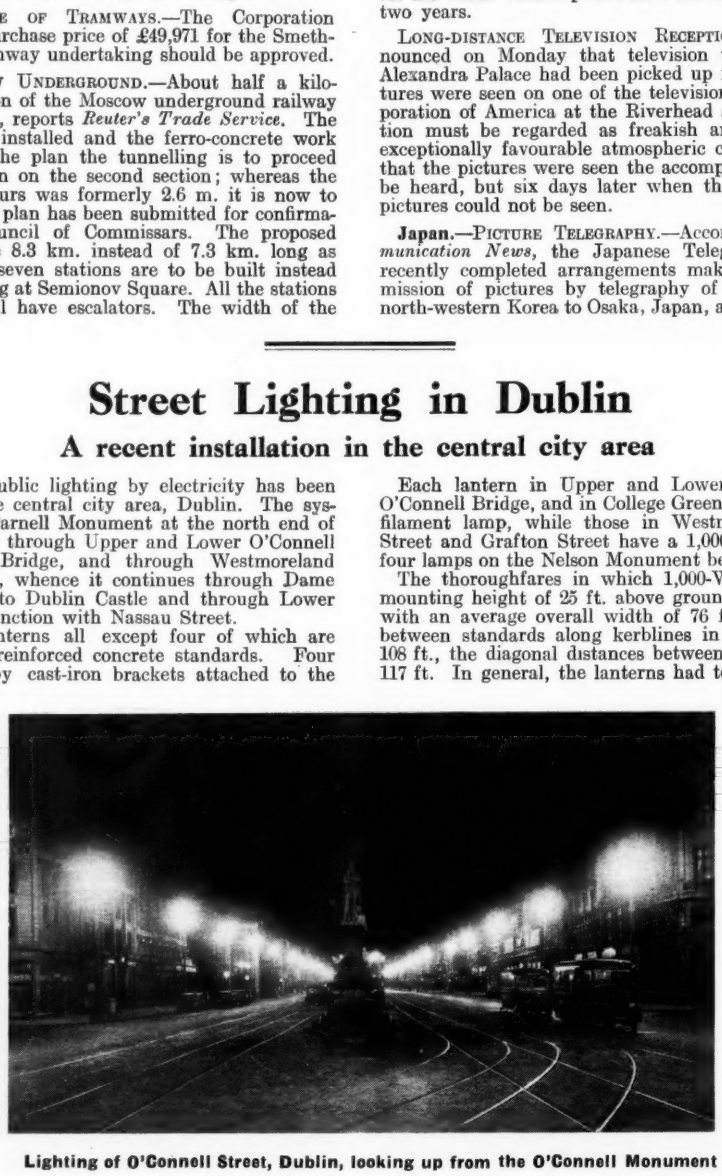
Japan.—PICTURE TELEGRAPHY.—According to *Foreign Communication News*, the Japanese Telegraph Department has recently completed arrangements making possible the transmission of pictures by telegraphy of military operations in north-western Korea to Osaka, Japan, a distance of 1,366 miles.

Street Lighting in Dublin

A recent installation in the central city area

A NEW system of public lighting by electricity has been inaugurated in the central city area, Dublin. The system extends from the Parnell Monument at the north end of Upper O'Connell Street, through Upper and Lower O'Connell Street, over O'Connell Bridge, and through Westmoreland Street to College Green, whence it continues through Dame Street to the entrance to Dublin Castle and through Lower Grafton Street to the junction with Nassau Street.

It comprises 196 lanterns all except four of which are carried in pairs on 96 reinforced concrete standards. Four lanterns are carried by cast-iron brackets attached to the corners of the plinth of the Nelson Monument. In Upper and Lower O'Connell Street, on O'Connell Bridge, and in College Green, the height to the light sources from ground level is 30 ft. In Westmoreland Street, Dame Street and Lower Grafton Street the height to the light sources is five feet lower. The concrete of which the standards are made is unusual in type, crushed natural marble being used in place of the normal broken stone or gravel. The surfaces when polished have an appearance similar to terrazzo work. The base of each standard houses the electrical apparatus and an anti-condensation chamber is incorporated in the cast bronze head of each lantern.



Lighting of O'Connell Street, Dublin, looking up from the O'Connell Monument

The internal refracting units comprises three pieces of prismatic glassware, two of which are hermetically sealed together in the form of an inverted bowl with a cavity between its internal and external surfaces, and together form the upper member of the unit. The mouth of the bowl is covered by the third glass which is shaped like a deep dish.

Each lantern in Upper and Lower O'Connell Street, on O'Connell Bridge, and in College Green is fitted with a 1,500-W filament lamp, while those in Westmoreland Street, Dame Street and Grafton Street have a 1,000-W filament lamp, the four lamps on the Nelson Monument being rated at 500 W.

The thoroughfares in which 1,000-W lamps are used at a mounting height of 25 ft. above ground level have a roadway with an average overall width of 76 ft. 6 in. The distances between standards along kerblines in these sections average 108 ft., the diagonal distances between standards being about 117 ft. In general, the lanterns had to be capable of producing their greatest intensity of light at an angle of 67 deg. from the standards in the vertical plane, and 26 deg. from the kerblines in the horizontal plane.

The thoroughfares in which 1,500-W lamps are used have an average road path width of 147 ft. and the distances between standards along kerblines averages 116 ft. The lanterns here had to be capable of producing their greatest intensity of light at an angle of 69½ deg. from the standards in the vertical plane and 46½ deg. from the kerblines horizontally.

While the vertical angles are quite usual in street lighting practice, the degrees of asymmetry required are unusual, as normally 15 deg. of asymmetry is sufficient in installations in which the lamps are situate in the kerblines. A full range of measurements has not yet been taken, but check measurements that have been made indicate that the test point reading in the installation will prove to be 1.25 ft.-candles and that the diversity of illumination over the surface of the road is not greater than four to one.

FINANCIAL SECTION

New Companies. Official Returns of Capital. Debenture Charges. Reports of Electrical Companies. Dividend Announcements. Transactions in Stocks and Shares

New Companies Registered

Wire Broadcasting Co., Ltd.—Private company. Registered December 24th. Nominal capital, £15,000. Objects: To adopt an agreement with P. P. Eckersley and R. E. H. Carpenter whereby they agree to grant to the company the sole and exclusive licence to use, for high-frequency wire broadcasting purposes only, certain patents relating thereto and to engage in research work of all kinds with a view to the improvement and exploiting of such broadcasting, &c. The first directors are: P. P. Eckersley, R. E. H. Carpenter, and others to be appointed by the subscribers. Solicitors: Stafford Clark & Co., 3, Laurence Pountney Hill, E.C.

P. T. M. Electric, Ltd.—Private company. Registered December 24th. Capital, £1,000. Objects: To carry on the business of manufacturers of and dealers in radio, television, electrical and telephone apparatus, &c. The permanent directors are: J. G. Pain, 14, Pine Gardens, Eastcote, Ruislip, and two others. Registered office: 92, Victoria Street, S.W.1.

F. & F. Electrical Fittings, Ltd.—Private company. Registered December 24th. Capital, £2,000. Objects: To carry on the business of manufacturers of and dealers in electrical, radio and television fittings, &c. The subscribers are: F. J. Funk, 10, Courtleigh Bridge Lane, N.W.11; and A. Kerstein, 3-4, Clement's Inn, W.C.2. F. J. Funk signs as director. Solicitors: Alfred Kerstein & Co., 3-4, Clement's Inn, Strand, W.C.2.

H. Barry, Ltd.—Private company. Registered December 28th. Capital, £100. Objects: To acquire the business of an electrical contractor and engineer carried on by Hyman Barry at 76, Margery Park Road, Forest Gate, E., and to carry on the same and the business of radio and television engineers, &c. The directors are: H. Barry and Mrs. A. M. J. Barry, both of 76, Margery Park Road, E.7. Registered office: 76, Margery Park Road, Forest Gate, E.7.

Quantock Electric Co., Ltd.—Private company. Registered December 23rd. Capital, £500. Objects: To carry on the business of electrical and wireless engineers, &c. The permanent directors are: A. R. Stowell, 37, Quantock Road, Bridgwater, and two others. Secretary: V. C. Burston. Registered office: 33, Friarn Street, Bridgwater.

Independent Development & Construction Co., Ltd.—Private company. Registered December 24th. Capital, £100. Objects: To acquire and turn to account patents, licences and concessions, to carry on the business of electricians, electrical engineers, manufacturers of and dealers in electrical appliances, apparatus, novelties and specialities, &c. The permanent directors are: J. D. Olding, 8, North Audley Street, W.1, and two others. Registered office: 8, Orange Street, W.C.2.

D. C. Engineering Co., Ltd.—Private company. Registered December 23rd. Capital, £2,000. Objects: To carry on the business of electrical, wireless, mechanical, consulting and general engineers, &c. The directors are: E. H. Turle, Deerhurst, Beckenham, Kent (chairman); and R. O. Girdlestone, Greenhill Court, Sherborne, Dorset.

Cumberland Finance Co., Ltd.—Private company. Registered December 19th. Capital, £6,000. Objects: To carry on the business of a finance company for the purpose of financing dealers in or manufacturers of wireless and television apparatus, electrical fittings, &c. The directors are: R. Smith (permanent managing director), 7, Egremont Road, Whitehaven, and two others.

R.E.P. Manufacturing Co., Ltd.—Private company. Registered December 22nd. Capital, £100. Objects: To carry on the business of electrical, mechanical and general engineers, manufacturers and sellers of and dealers in apparatus, appliances and devices for use in connection with the recording, reproduction, transmission, reception or intercommunication of sound, speech, music, &c. The subscribers are: R. S. Sweeting and D. J. H. Sweeting, both of 11, Porchester Gardens, W.2. Solicitors: Gisborne & Co., Temple Chambers, Temple Avenue, E.C.4.

Gresham Transformers, Ltd.—Private company. Registered December 30th. Capital £500. Objects: To carry on the business of general and electrical engineers, manufacturers of electrical transformers, resistances, switches, and other electrical apparatus, &c. The subscribers are: E. Cheston, 44, Constance Road, Whitton, and J. J. Elsden, 54, St. James's Road, Hampton Hill. Secretary: J. J. Elsden. Registered office: 34-35, Gresham Street, E.C.2.

Terrys Wireless (1938), Ltd.—Private company. Registered December 30. Capital £500. Objects: To carry on the business of manufacturers, repairers and hirers of and dealers in electrical and mechanical apparatus and accessories, wireless and radio sets and valves, &c. The directors are: I. Hillman and Mrs. M. Hillman, both of 3, Leadale Road, N.16. Registered office: 219, Whitechapel Road, E.1.

Franklin & Freeman (London), Ltd.—Private company. Registered December 30th. Capital £200. Objects: To take over the firm of Franklin & Freeman, Ltd. (in voluntary liquidation), and to carry on business as manufacturers of commutators and all appliances for the wireless and electrical trades, &c. The directors are: M. Freeman, 34, Sharon Gardens, E.9, and S. Green, 35, Fox Lane, N.13. Registered office: 152, Commercial Street, E.1.

Patrick Adie, Ltd.—Private company. Registered December 30th. Capital £10,000. Objects: To carry on business as manufacturers of and dealers in dynamos, motors, armatures, magnetos, &c. The subscribers are: S. J. Shippick, Dillywood Corner, Gravesend Road, Rochester, and F. W. Hallewell, 44, Ingles Road, W.5. Secretary: W. T. Robins. Registered office: 5 & 6, Bucklersbury, E.C.

Returns of Electrical Companies

Statements of Capital

Radenite Batteries, Ltd.—Capital £20,000 in £1 shares. Return dated October 19th, 1938. 6,754 shares taken up. £4,654 paid. £2,100 considered as paid. Mortgages and charges: nil. On November 16th, 1938, a further 10,131 shares were allotted as fully paid by way of "capitalisation of undivided profits."

Sun Electrical Company, Ltd.—Capital, £250,000 in 125,000 7½ per cent. preference and 125,000 ordinary shares of £1. Return dated October 20th, 1938. 125,000 preference and 93,311 ordinary shares taken up. £218,311 paid. Mortgages and charges, nil.

R. & W. (Electrical), Ltd.—Capital, £2,550 in 1,000 shares of 1s. each and 2,500 shares of £1. Return dated October 20th, 1938. 1,000 1s. and 1,500 £1 shares taken up. £1,550 paid. Mortgages and charges: £750 debentures.

Dunmow Light and Heat Co., Ltd.—Capital, £10,000 in £1 shares. Return dated October 21st, 1938. 8,500 shares taken up. £8,500 paid. Mortgages and charges: £1,500 debentures.

Mortgages and Charges

Best & Lloyd, Ltd.—Satisfaction to the extent of £4,000, on December 8th, 1938, of debentures authorised June 18th, 1935, and registered July 3rd, 1935, securing £20,000.

Particulars filed of £2,000 debentures, authorised December 8th, 1938, charged on the company's undertaking and property, present and future, including uncalled capital, the whole amount being now issued and ranking *pari passu* with debentures dated June 26th, 1935.

Walter Jones & Co. (Engineers), Ltd.—Charge on 36 & 38, Newlands Park, Beckenham, dated December 16th, 1938, to secure all moneys due or to become due from the company to Barclays Bank, Ltd.

C. T. Briscoe & Son, Ltd.—Mortgage on 33 & 33a, Preston New Road, Blackburn, dated December 13th, 1938, to secure £1,000. Holders: The Misses H. & M. E. Bottomley, both of Mytton Hall, Mytton, near Whalley, Lancs.

Receivers Appointed

Walton Electric Installations, Ltd.—J. W. Westle, of Oakhill Bungalow, Lydiate, near Liverpool, was appointed receiver and manager on December 21st, 1938, under powers contained in debenture dated January 20th, 1938.

Reeve, Barlow, Ltd.—R. H. French, chartered accountant, of 10, Ashley Place, Westminster, S.W.1, was appointed receiver and manager on December 16th, 1938, under powers contained in debenture dated April 28th, 1938.

Increases of Capital

Bush Radio, Ltd.—The nominal capital has been increased by the addition of £77,500 beyond the registered capital of £2,500. The additional capital is divided into 310,000 ordinary shares of 5s. The 2,500 ordinary shares of £1 in the original capital have been divided into 10,000 ordinary shares of 5s.

Wellington District Electricity Co., Ltd.—The nominal capital has been increased by the addition of £10,000 in £1 ordinary shares beyond the registered capital of £60,000.

Exe Valley Electricity Co., Ltd.—The nominal capital has been increased by the addition of £25,000 in £1 ordinary shares beyond the registered capital of £200,000.

Fleet Electrics, Ltd.—The nominal capital has been increased by the addition of £4,500 in £1 ordinary shares beyond the registered capital of £500.

S. Hathaway & Co., Ltd.—The nominal capital has been increased by the addition of £3,500 beyond the registered capital of £1,500. The additional capital is divided into 3,500 8 per cent. cumulative preference shares of £1.

Reports and Dividends

The British Vacuum Cleaner & Engineering Co., Ltd.—Presiding at the annual meeting on December 30th Mr. H. C. Booth (chairman and joint managing director) said that their new works at Leatherhead were well equipped and provided facilities for a considerably increased volume of production with ample area for expansion, while providing ideal conditions of employment. While by far the greater proportion of their business was centred around the manufacture and sale of domestic type vacuum cleaners, during the year under review they had again carried out a considerable number of important central cleaning installations, including plants for the Southern Railway, London Passenger Transport Board, various power stations and industrial works, also cinemas and other public buildings. They had also received orders from various Government Departments. Substantial progress was being made with their new lines of manufacture.

Scophony, Ltd., held its annual meeting on December 30th when Sir M. Bonham-Carter (chairman), who presided, said that so far Scophony had taken the view that owing to the present small demand for television sets, small scale manufacture was unremunerative, and preferred to devote its resources to the further development and improvement of the system. While still adhering to a cautious policy, the company felt justified in the initiation now of manufacturing and marketing arrangements in respect of home receivers. They anticipated that when a separate cinema service was established Scophony cinema television apparatus would prove an important source of revenue to the company. They were also manufacturers of transmission equipment and had delivered equipment to the Russian Government.

Vactric, Ltd., held its annual meeting on December 30th, Mr. S. Kingsley Tubbs (chairman) presiding. In the course of his remarks the chairman said that the year under review opened in a very promising manner, but that state of affairs unfortunately was not maintained throughout the period covered by the accounts, partly by reason of political and economic circumstances beyond the control of the board, which affected both home and foreign markets. Despite these difficult trading conditions the company's sales were, in fact, nearly maintained; further, as a result of certain economies the expenses for the year were reduced by £18,000. The reason for the decreased profit was found in the fact that the gross profit earned fell very materially. This could be accounted for partly by the increased cost of certain materials, partly by the relative increase in the sales of lower priced models, and partly by increased competition, particularly in the export market, but the large drop in the gross profit rate was having urgent and close attention.

The Electrical Apparatus Co., Ltd., reports a net profit for the year ended August 22nd of £20,790, as compared with £19,164 in the preceding year, to which is added £14,431 brought in, making £35,221. The dividend for the year on the ordinary shares is 7½ per cent., less tax (against 5 per cent.), £1,833 is applied to writing patterns and drawings down to £1, general reserve receives £3,000 and the balance carried forward is £22,128. The report states that one week's holiday with pay is now granted to the workpeople.. The works at St. Albans have been largely extended and suitable offices built, and on October 1st the head office and all manufacturing previously done at Vauxhall were transferred to St. Albans. Pending disposal, Vauxhall Works remains the company's London office. Business continues to be satisfactory, and the enlarged St. Albans works is fully occupied.

Ismay Industries, Ltd., on the advice of the auditors, have decided to defer the payment of the interim dividend on the 5½ per cent. cumulative preference shares due for payment on January 1st pending the completion of the annual accounts as at October 31st. In a circular containing the announcement it is stated that the provisional agreement for the sale of certain interests was confirmed at an extraordinary meeting of John Ismay & Sons on December 22nd. The sale of the undertaking and assets of Ismay Cables was completed on December 21st. These transactions, it is stated, have materially strengthened the resources of the company, and resulted in a substantial reduction of its bank indebtedness. It is emphasised that, notwithstanding investment losses that will have to be borne by the ordinary shareholders, there is no intention of reducing or altering in any way the rights and interests of the preference shareholders.

The Hydro-Electric Securities Corporation has declared the usual half-yearly dividend on the 5 per cent. class "B" cumulative preferred participating shares.

The Nigerian Electricity Supply Corporation, Ltd., has announced an interim dividend on the preferred ordinary of 3½ per cent., less tax (same).

The Great Northern Telegraph Co. has declared an interim dividend of 2½ per cent. for the second half of 1938 (same).

Stocks and Shares

TUESDAY EVENING.

STOCK Exchange markets started the New Year in a reasonably hopeful mood. British Government securities and gilt-edged stocks as a whole show a disposition to strengthen. Probably some of the interest and dividend money released to security holders at the beginning of the year is finding its way back into channels of reinvestment.

The outstanding feature, so far as market fluctuations are concerned, is the strength of the American market. President Roosevelt's message to Congress was anticipated as likely to prove more helpful to the bull party than to the New Dealers.

If it cannot be said that business conditions in the Stock Exchange have displayed noticeable improvement, at least it may be stated that most prices exhibit firmness. The political outlook on the Continent is regarded as being, for the moment, rather more tranquil. At home, the advent of a new and substantial defence loan is awaited with a degree of that philosophy which is akin to resignation.

Price Movements

Steel companies' shares have taken a leading place in the week's upward move amongst industrial prices. In many sections, the improvement was more noticeable in the atmosphere than in quotations. Electrical equipment shares, for instance, show very few changes—and these few include a drop of 1s. 3d., to 35s., in Johnson & Phillips. In the same market, Telegraph Constructions have had a relapse from 12s. 6d. to 10s., with bargains recorded down to 6s. 6d. Electricity Supply shares are steady: the gilt-edged market has been appreciably harder. Home Railway stocks continued upwards, together with hopes of at least a partial success for the "square deal" appeal. Cable and Wireless ordinary stock at 35½ is nearly at the lowest point touched in 1938. The preference has further weakened to 76¼.

Electricity Overseas

The rising consumption of electricity in many parts of the world has enabled a number of overseas supply companies to weather satisfactorily a difficult period. Victoria Falls Power, for instance, raised the ordinary dividend last year from 12 to 13¼ per cent., thanks, largely, to the activity of the Rand gold mines. The price of the shares rose from 60s. to 68s. 9d. on the year. Shares in the big Indian supply companies more than held their ground. The Palestine and Jerusalem Electric stocks are actually a shade better, despite the local troubles. Canadian stocks found new favour in European eyes because of the Dominion's geographical position in relation to the danger areas, and on account also of better business prospects. Montreal Power and Shawinigan Power stocks are two or three dollars to the good. South America has been an unhappy field for British investors, but the estimates of next season's crops in the Argentine Republic give relief to last year's poor record. Brazilian Tractions were 12¾ twelve months ago; the price finished up 1938 in single figures, following the intimation that remittances out of the country dried up several months previously. Mexican stocks have slumped.

America

Wall Street ended the year with prices near the top of a remarkable six months' recovery. To judge, moreover, from the present behaviour, the market finds equal satisfaction in looking forward as backward. The various trade returns which are taken as indices to American industrial activity are generally considered to be pointing towards increase of prosperity in the New Year. The mainspring is recognised to be the U.S. Government's outpouring of money into public works, armaments, and so on. When this comes to an end, it remains to be seen whether private enterprise, left to itself, will be able to keep up the pace. Railroad stocks have lately come well to the fore because of the belief in pending legislation to relieve the companies' present unhappy plight. Utilities are cheerful on the sharply rising trend of electricity output, which is responsible, also, for animation in electrical equipment issues. Portents suggest that the American influence on London markets is going to be helpful to the latter. It has to be remembered, of course, that European news carries a good deal of weight in Wall Street.

Preference and Debenture Stocks

Industrial preference shares of good standing can mostly be bought a shilling or two cheaper now than a year ago. The electricity supply market has seen a continuation of the movement away from high-priced issues into those standing near enough to par to rule out any serious consequences to a repayment of capital in the event of liquidation. While the low-priced shares show little change, there have been falls of up to 2s. in such preference issues as Edmundsons and North Eastern 7 per cents. In the electrical equipment field, typical changes are the losses of 2s. in Associated Electrical 8 per cent. preference; and of 1s. in Crompton Parkinson "eights." Yields range between 4 and 4½ per cent. in the electricity supply group, and rather higher on the electrical equipment shares. Debenture stocks in the leading supply undertakings have maintained their prices well. Backed with nearly gilt-edged security, they are still in keen demand at prices which give a yield only slightly above the level on British Government loans. These classes of investments have stood up well to the pressure which circumstances have imposed on the gilt-edged market and, consequently, on fixed-interest stocks in general. For comparison, it may be noted that Central Electricity Board issues have depreciated by two to three points, and certain London Transport loans by a still wider margin.

British Vacuum Cleaner

Following another successful year's trading, the British Vacuum Cleaner company intends to finance a further expansion of the business by the issue of 200,000 5s. shares at 20s. Shareholders have the right to apply for the shares on a one-for-two basis at a price which was well below the market value of the old shares. The latter are now quoted at 22s. ex rights. Dividends of 40 per cent. have been paid in each of the last three years. Vactric 5s. shares have fallen from 5s. to 3s. 3d.—having changed hands down to 2s. 1¼d.—since the cut in the dividend from 10 to 4 per cent. At last week's meeting the chairman gave reasons for expecting in the current year an improvement on the disappointing results.

Further developments affecting Ismay Industries shareholders went without effect on the price of the ordinary shares at 1s. 3d. In a notice which announces the deferment of the interim preference dividend, the company makes it clear that the ordinary shareholders will have to bear the brunt of the investment losses incurred during the year. The sale of the Ismay Cables interest has been completed, but curiosity as to the name of the buyer is still unsatisfied.

Armament Finance

Next April's Budget stands out prominently—and somewhat starkly—in the market's New Year prospect. In the absence of a dramatic, and a sudden turn for the better in world affairs, a much higher level of national expenditure in 1939 has to be taken for granted: the only doubt concerns the way and means to be adopted by the Chancellor in providing the extra money. Taxation beyond the present rate would have, it is felt, so dispiriting an effect on trade as to make its avoidance a matter of urgency. Government borrowing is the more likely—and would certainly be the more popular—course. There is nothing very cheerful in the early prospects for the gilt-edged sections, but parts of the industrial market—particularly, of course, those connected with armament companies—stand to reap obvious benefits from the Government spending. The prospect of heavy Budget deficiencies covered by borrowing introduces into the situation an inflationary element which favours ordinary shares at the expense of fixed-interest securities. In addition to growing steadiness of the trade returns, these are considerations which helped the industrial markets to finish last year in fairly good style.

ELECTRICAL COMPANIES' SHARES

Prices, dividends and yields

Company.	1938. High-est.	1938. Low-est.	Dividend. Pre-vious.	Dividend. Last.	Price Jan. 3	Rise or Fall.	Yield p.c. £ s. d.
Home Electricity Companies							
Bournemouth and Poole ...	68/3	62/–	15	15	67/6	—	4 9 0
British Power & Light ...	30/9	24/6	6	7	27/6	—	4 18 3
City of London	34/6	28/6	7½	7⅞	32/–	—	4 13 9
Clyde Valley	42/6	33/–	8	8	36/3	—	4 8 2
County of London... ...	51/9	38/9	10½	10½	44/6	—	4 14 5
Edmundson's :							
7% Pref....	33/3	30/–	7	7	31/3	—	4 9 6
Ord.	40/9	18/9	9	9	25/6	—	—
Elec. Dis. Yorkshire ...	43/6	37/9	9	9	41/3	—	4 7 5
Elec. Fin. and Securities...	51/9	49/–	12½	12½	47/6	—	5 5 3
Elec. Supply Corporation...	55/–	50/–	12	12	51/3	—	4 13 5
Isle of Thanet	21/3	18/6	4	4	20/–	—	4 0 0
Lancs Light and Power ...	35/–	26/–	7½	7½	30/9	—	4 17 7
Llanelly Elec.	23/6	21/–	5½	5½	21/6	—	5 2 4
Lond. Assoc. Electric ...	32/9	28/–	7	7	29/6	—	4 13 4
London Electric	36/3	32/–	7	7	33/–	—	4 4 10
London Power Deb. Red.	108¾	100	5	5	106	—	4 14 6
Metropolitan	51/–	41/–	10	12	48/3	—	4 19 7
Midland Counties	39/9	33/–	8	8	35/–	—	4 11 6
Mid. Elec. Power	41/9	37/–	8	9	40/–	—	4 10 0
Newcastle Elec.	31/9	27/6	7	7	28/9	—	4 17 4
North Eastern Electric :							
Ordinary...	34/–	25/–	7	7	30/–	—	4 13 4
7% Pref....	34/–	30/–	7	7	32/–	—	4 7 6
Northampton	47/6	43/9	10	10	46/3	—	4 6 7
Notting Hill 6% Pref. (£10)	14½	13½	6	6	13½	—	4 12 4
North Met. Elec. :							
Ordinary...	49/–	43/–	10	10	45/–	—	4 9 0
6% Pref....	30/6	28/3	6	6	29/–	—	4 2 9
Richmond Elec.	30/6	28/–	7	7	28/9	—	4 17 5
Scottish Power	38/9	32/–	8	8	35/–	—	4 11 6
Southern Areas	22/9	18/6	4½	5	21/3	—	4 14 1
South London	32/6	31/–	7	7	31/6	—	4 9 0
West Devon	23/3	21/3	5	5	1¼	—	4 9 0
West Glos.... ...	19/–	16/9	2	2	19/6	—	2 1 0
Yorkshire Elec.	42/–	36/9	8	8	38/6	—	4 3 0
Overseas Electricity Companies							
Atlas Elec.	4/6	2/6	Nil	Nil	2/9	—	—
Calcutta Elec.	44/3	36/3	12*	10*	2	—	5 0 0
Cawnpore Elec.	40/–	35/–	10	10	36/3	—	5 10 6
East African Power ...	28/3	22/6	7	7	24/–	—	5 16 8
Jerusalem Elec.	26/9	23/3	5	6	24/–	—	5 0 0
Kalgoorlie (10/–)	12/–	9/6	7½	7½	10/3	—	7 6 4
Madras	34/6	28/9	8*	8*	30/–	—	5 6 8
Montreal Power	31¼	26⅞	1½	1½	33	+½	—
Palestine Elec. "A" ...	31/9	27/–	7½*	7½*	30/–	—	5 0 0
Perak Hydro-electric ...	25/3	17/–	7	6	18/9	—	6 8 1
Shawinigan Power ...	23½	16½	65cts.	85cts.	22	+½	—
Tokyo Elec. 6%	65½	39	6	6	52½	−3	11 8 6
Victoria Falls Power ...	76/3	55/–	12	13½	68/9	+6d.	3 18 6
Whitehall Investments Pref.	22/3	15/–	7½	7½	17/6	—	8 11 6
Public Boards							
Central Electricity :							
1950–70	115⅜	97	5	5	110½	—	4 10 6
1955–75	118½	100	5	5	113½	—	4 8 1
1951–73	111	95	4½	4½	106½	—	4 4 6
1963–93	101	85	3½	3½	95½	—	3 13 4
London Elec. Trans. Gtd.	93½	88	2½	2½	88½xd.	—	2 16 6
London & Home Counties,							
1955–75	112⅞	97½	4½	4½	108xd.	—	4 3 4
Lond. Passenger Transport :							
A...	119½	104⅜	4½	4½	111½	+1	4 0 9
B...	122⅜	105	5	5	116½	+1	4 5 10
C	84	68	4½	4	74	—	5 8 1
West Midlands Joint Elec.,							
1948–68	115½	102½	5	5	113	—	4 8 6
Telegraph and Telephone							
American Tel. & Tel. ...	160	114	9	9	160½	+2	5 12 2
Anglo-Am. Tel. :							
Pref.	115½	100½	6	6	100½	—	5 19 5
Def.	28	23	1½	1½	23½	—	6 7 8
Anglo-Portuguese	23/6	19/3	8	8	21/3	—	7 10 7
Cable & Wireless :							
5½% Pref.	104	76½	4½	5½	76½	−1	7 12 0
Ord.	67⅜	34	—	4	35½	—	11 4 4
Income	102½	99	—	—	99½	—	4 0 5
Canadian Marconi $1 ...	6/6	3/9	—	Nil	4/6	−3d.	—
Globe Tel. & Tel. :							
Ord.	32/6	26/3	5½*	7½*	25/9	—	5 16 6
Pref.	27/6	23/9	6	6	26/3	—	4 11 5
Great Northern Tel. (£10)...	42½	34	20	20	37	—	5 8 1
Inter. Tel. & Tel.	12½	5¼	Nil	Nil	10½	+½	—
Marconi-Marine	30/6	21/6	10	7½	23/9	—	6 6 4
Oriental Telephone Ord. ...	59/3	2½	12*	12*	2⅝	—	4 11 3
Radio Corpn.	9½	4⅜	8	6	8⅛	+⅛	—
Telephone Props	13/9	11/3	5	6	13/9	—	8 14 6
Telephone Rentals (5/–) ...	10/–	7/6	5	6	9/6	+3d.	3 3 2
Western Union	34½	17	2⅜	—	25	+2½	—
Traction and Transport							
Anglo-Arg. Trams :							
First Pref.	11/–	2/6	Nil	Nil	3/9	—	—
4% Inc.	31	8	Nil	Nil	9	—	—
British Electric Traction :							
Def. Ord.	1060	675	5	6	900	—	—
Pref. Ord.	175	150	8	8	160	—	5 0 0
Bristol Trams	45/–	34/3	5	8	41/3	+6d.	3 17 6
Brazil Traction	14½	7½	$1	—	9½	—	—
Calcutta Trams	26/9	21/6	8	8	24/6	—	6 10 8
Cape Elec. Trams	18/6	15/6	5	6	17/6	—	6 17 2
Lancs Transport	35/3	29/3	10	10	36/3	—	5 10 3
Mexican Light :							
1st Bonds	39	16½	5	5	25	—	—
Rio 5% Bonds	91	47	5	5	50	—	10 0 0
Southern Rly :							
5% Prefd.	87	48	5	—	58	+1	—
5% Pref....	116	83	5	5	92½	+1	5 8 3
T. Tilling	60/–	36/6	10	10	43/3	+9d.	4 14 1
Tilling & B.A.	57/–	46/–	6	10	50/–	—	4 0 0
West Riding	46/3	30/6	10	10	33/9	—	—
Equipment and Manufacturing							
Aron Electricity Ord. ...	40/3	31/–	15	15	1 1/16	—	9 12 0
Assoc. Elec. :							
Ord.	45/3	32/–	10	10	39/–	—	5 2 8
Pref.	38/9	35/6	8	8	36/–	—	4 9 0
Automatic Telephone & El.	43/–	35/–	5	10	41/3	—	4 17 1
Babcock & Wilcox ...	44/–	32/6	10	10	38/3	+2/6	5 10 8
British Aluminium Ord. ...	54/–	40/–	10	12½	55/–	+6d.	4 11 0
British Insulated Ord. ...	95/9	77/–	20	20	4 3/16	+ 1/16	4 15 10
British Thermostat (5/–) ...	16/–	9/–	17½	18½	15/9	—	5 17 6
British Vacuum Cleaner (5/-)	35/9	27/–	40	40	22/–xr.	—	—
Brush Ord.	5/6	4/9	Nil	Nil	5/–	—	—
Callender's	5½	78/6	20	20	77/6	—	5 3 3
Chloride Elec. Storage ...	77/9	61/ ·	15	20	77/6	—	5 3 3
Consolidated Signal ...	116/–	75/–	30	36½	4½	−½	7 18 0
Crabtree (10/–)	29/–	22/–	17½	17½	23/3	−6d.	7 10 4
Crompton Parkinson :							
Ord. (5/–)	32/3	18/9	12½	15	15/3xr.	—	—
E. K. Cole (5/–)	8/9	4/6	5	10	6/–	—	8 6 8
Elec. & Musical Industries (10/–)	16/3	9/–	10	5	10/9	+3d.	4 13 0
Electric Construction ...	36/–	31/–	10	12½	32/6	—	7 13 10
Enfield Cable Ord. ...	5 5/16	46/–	25	25	2 5/16	—	—
Electrical Switchgear (10/–)	27/–	22/6	16	16	25/9	—	6 4 4
English Electric	33/–	24/6	Nil	10	33/–	—	6 1 3
Ensign Lamps (5/–) ...	14/3	11/3	—	25	14/6	+3d.	8 12 6
Ericsson Tel. (5/–) ...	2 3/16	31/–	25*	25*	38/9	—	3 4 6
Ever Ready (5/–)	26/3	16/6	45	35	21/–	—	8 6 8
Falk Stadelmann	34/3	27/–	10	10	27/6	—	7 5 6
Ferranti Pref.	27/6	25/–	7	7	25/–	—	5 12 0
G.E.C. :							
Pref.	34/–	31/3	6½	6½	31/3	—	4 3 2
Ord.	79/3	67/–	17½	20	76/6	—	5 4 7
Greenwood & Batley ...	27/6	19/–	7	15	26/3	—	11 8 6
Hall Telephone (10/–) ...	24/6	18/3	5	15	21/3	—	7 1 2
Henley's (5/–)	21/–	16/–	15	20	19/6	—	5 2 7
4½% Pref.	23/–	22/–	4½	4½	22/6	—	4 0 0
Hopkinsons	40/–	32/6	10	12½	38/9	—	6 8 10
India-Rubber Pref. ...	21/9	20/3	5½	5½	21/3	—	5 3 6
Intl. Combustion	5/8	4½	30	32½	5⅜	—	6 0 10
Ismay Industries (5/–) ...	6/9	1/–	6	6	1/3	—	—
J. Lucas	57/9	47/6	15	15	56/3	—	5 6 9
Johnson & Phillips ...	43/9	32/6	10	12½	35/–	−¼	7 2 10
Lancashire Dynamo ...	72/3	53/–	20	25	65/–	—	7 14 0
Laurence Scott (5/–) ...	12/–	9/–	7	15	12/–	—	6 5 0
London Elec. Wire ...	35/–	28/3	12	7½	30/–	—	5 0 0
Mather & Platt	49/–	41/3	12	13½	46/3	—	5 17 0
Metropolitan Elec. Cable Pf.	22/–	21/–	5½	5½	21/3	—	5 3 6
Murex	93/9	66/3	20	20	75/–	−1/16	5 6 8
Pye Deferred (5/–) ...	12/–	8/–	5	25	9/6	—	13 3 2
Revo (10/–)	36/3	30/–	12	17½	35/–	—	5 0 0
Reyrolle	62/6	49/–	12½	12½	55/9	—	4 10 0
Siemens Ord.	31/–	20/6	7½	7½	21/3	—	6 13 4
Strand Elec. (5/–) ...	6/–	4/–	5	10	5/–	—	10 0 0
S. Smith (1/–)	9/9	6/3	37½	50	8/9	—	6 6 0
Switchgear & Cowan (5/–)	19/6	12/6	20	20	15/–	—	6 13 4
Telegraph Condenser (10/–)	18/9	12/–	5	5	10/–	−½	5 0 0
Telegraph Construction ...	2½	36/–	7½	10	2½	—	4 14 1
Telephone Mfg. (5/–) ...	9/9	7/–	9	9	8/6	—	5 6 0
Tube Investments... ...	89/6	70/–	23½	23½	4 1/16	+ 1/16	5 10 0
Vactric (5/–)	9/9	4/6	10	4	3/3	−6d.	6 3 2
Vickers (10/–)	27/–	17/6	10	10	23/6	+1/6	4 15 0
Westinghouse Brake ...	63/9	45/–	15	17½	54/–	—	6 9 8
Walsall Conduits (4/–) ...	26/–	22/6	—	55	25/9	—	8 11 0
West, Allen (5/–)	6/6	4/6	—	7½	6/6	—	5 15 5

* Dividends are paid free of Income Tax.

NEW PATENTS

Electrical specifications recently published

Compiled by a firm of chartered patent agents. The numbers under which the specifications will be printed and abridged are given in parentheses. Copies of any specification (1s. each) can be obtained from the Patent Office, 25, Southampton Buildings, London, W.C.2.

1937

6685. "Thermionic-valve amplifiers." E. L. C. White and J. Hardwick. March 6th, 1937. (496872.)

9255. "Electron-discharge devices employing magnetic focusing arrangements." H. Miller. April 1st, 1937. (496751.)

9393. "Mechanical and electrical connecting means for lighting fittings." J. Studholme and Benjamin Electric, Ltd. April 2nd, 1937. (496810.)

9890. "Tuning indicators for wireless receivers." General Electric Co., Ltd., R. Gosden, S. G. Hunter and E. L. Mercer. April 7th, 1937. (Cognate application 31335/37.) (496874.)

10004. "Electric furnaces." T. D. Kelly. April 8th, 1937. (496937.)

12508. "Methods of regulating vapour arc convertors." General Electric Co., Ltd., and C. R. Dunham. May 1st, 1937. (496811.)

12557. "Electro-magnetic deflecting coils for cathode-ray tubes." Telefunken Ges. für Drahtlose Telegraphie and R. Andrieu. May 3rd, 1937. (Addition to 433996.) (496812.)

12597. "Scanning devices for television and the like." Zeiss Ikon Akt.-Ges. May 6th, 1936. (496756.)

13203. "Magneto generators." Bendix Aviation Corporation. May 9th, 1936. (497002.)

13234. "Electron multipliers." F. J. C. Van Den Bosch. May 29, 1937. (496939.)

13382. "Thermionic-valve repeating arrangements." W. S. Percival. May 11th, 1937. (497004.)

15385. "Safety switch mechanism for electric wash-boilers and the like." J. H. Tucker and Co., Ltd., F. C. Fuke and R. G. Avison. June 3rd, 1937. (496940.)

15575. "Electric control of variable-speed gears." Siemens-Schuckertwerke Akt.-Ges. June 4th, 1936. (496947.)

15614. "Installation of switches and other electrical apparatus." J. A. Crabtree and Co., Ltd., H. F. McLoughlin and B. G. Harrison. June 5th, 1937. (496948.)

15620. "Thermionic-valve amplifying circuits." A. D. Blumlein. June 5th, 1937. (496883.)

15715. "Sealing valve for mercury-vapour rectifiers." English Electric Co., Ltd., and W. R. Evans. June 7th, 1937. (496814.)

15772. "Electric switchgear incorporating a mercury switch." British Electric Transformer Co., Ltd., and R. Weaving. June 7th, 1937. (496758.)

15780. "Arrangements for measuring differences of potential." E. H. Greibach. June 10th, 1936. (497057.)

15895. "Electrically illuminated house-sign devices." G. Hertel and E. Gude. June 8th, 1937. (496958.)

15902. "Means for controlling the electrode feeding mechanism of direct-current electric arcs." S. A. Stevens and Westinghouse Brake and Signal Co., Ltd. June 8th, 1937. (496960.)

15908. "Mercury switches." A. C. Lindstrom. June 8th, 1937. (Convention date not granted.) (496961.)

15938. "Thermionic amplifiers." A. D. Blumlein. June 9th, 1937. (497060.)

15987. "Sealing of leading-in conductors into electric lamps." General Electric Co., Ltd. November 28th, 1936. (497061.)

15992. "Electrical signalling systems." Automatic Telephone and Electric Co., Ltd., and T. B. D. Terroni. June 9th, 1937. (497015.)

16015. "Systems of electric motor control." British Thomson-Houston Co., Ltd., and L. D. Anscombe. June 9th, 1937. (496897.)

16017. "Electric transformers." British Thomson-Houston Co., Ltd. June 12th, 1936. (497064.)

16082. "Methods of manufacturing mosaic electrodes." Fernseh Akt.-Ges. June 17th, 1936. (497018.)

16085. "Manufacture of ceramic electrically insulating bodies." Marconi's Wireless Telegraph Co., Ltd. June 10th, 1936. (496762.)

16099. "Television receivers." Scophony, Ltd., and J. H. Jeffree. June 10th, 1937. (496964.)

16242. "Synchronisation generator for television systems." Radioakt.-Ges. D. S. Loewe. June 13th, 1936. (497071.)

16260. "Dry-plate rectifiers." British Thomson-Houston Co., Ltd. June 13th, 1936. (497032.)

16261. "Dry rectifiers." British Thomson-Houston Co., Ltd. June 13th, 1936. (497033.)

16263. "Dry rectifiers." British Thomson-Houston Co., Ltd. June 13th, 1936. (Cognate application 16264/37.) (497034.)

16277. "Protective systems for radio transmitters." Standard Telephones and Cables, Ltd. (R. Pièce). June 11th, 1937. (497035.)

16292. "High-tension electric switchgear." Siemens-Schuckertwerke Akt.-Ges. June 12th, 1936. (497038.)

18434. "Electron-discharge devices." Standard Telephones and Cables, Ltd. July 3rd, 1936. (496973.)

21178. "Method of and apparatus for measuring electrical capacity and other magnitudes." Murphy Radio, Ltd., W. B. Bartlev, S. R. Tomes and E. L. White. July 30th, 1937. (496825.)

27398. "Electric motor control systems." British Thomson-Houston Co., Ltd. October 8th, 1936. (496978.)

27830. "Doors for electric cooking apparatus." R. H. Rogers. June 1st. 1937. (Divided out of 15213/37.) (Cognate application 27091/37.) (496833.)

28141. "Cathode construction for electron-discharge devices." British Thomson-Houston Co., Ltd. October 16th, 1936. (496904.)

28708. "Tubular electric conductors." Felten and Guilleaume Carlswerk Akt.-Ges. November 26th, 1936. (496769.)

28866. "Telephone systems." Standard Telephones and Cables, Ltd. October 29th, 1936. (496905.)

28940. "Television receivers." General Electric Co., Ltd., and L. C. Jesty. October 22nd, 1937. (496835.)

29784. "Radio and television programmes indicator." J. C. Rogerson. September 15th, 1937. (Divided out of 13129/36.) (496837.)

30866. "Lighting fittings." Holophane, Ltd., and S. English. November 10th, 1937. (Cognate application 642/38.) (496979.)

31876. "Thermionic valves." M-O Valve Co., Ltd., and G. W. Warren. November 19th, 1937. (496839.)

32219. "Semi-automatic telephone systems." Telefonaktiebolaget L. M. Ericsson. November 23rd, 1936. (496907.)

33118. "Radio shielding spark-plug connection." E. L. W. Byrne (Titeflex Metal Hose Co.). November 30th, 1937. (496841.)

33858. "Devices having hermetically sealed envelopes through which pass more than two leading-in conductors each carrying to an electrode a current of many amperes." M-O Valve Co., Ltd., D. A. Boyland and R. L. Breadner. December 7th, 1937. (496842.)

35007. "Tubular electric heating elements with moisture-proof seals." Siemens-Schuckertwerke Akt.-Ges. July 24th, 1937. (496982.)

35545. "Television or like systems and electron-discharge apparatus therefor." Baird Television, Ltd., C. Szegho and G. A. R. Tomes. June 4th, 1937. (Divided out of 477406.) (496778.)

35676. "Modulated carrier-wave transmitters." Marconi's Wireless Telegraph Co., Ltd., L. T. Moodey and C. R. Staines. December 23rd, 1937. (496845.)

35995. "Compressed-air-driven turbo-electric mine-lamps." W. Maurice and Wolf Safety Lamp (Hiring) Co., Ltd. December 29th, 1937. (Addition to 471865.) (496846.)

1938

4402. "Cathode-ray tubes." C. Lorenz Akt.-Ges. February 11th, 1937. (496785.)

7157. "Manufacture of highly exhausted discharge tubes." Naamlooze Vennootschap Philips' Gloeilampenfabrieken. March 9th, 1937. (496856.)

7297. "Adjustable inductance." Hazeltine Corporation. March 31st, 1937. (496912.)

8443. "Electric circuit-interrupters of the liquid-immersed type." Westinghouse Electric & Manufacturing Co. May 28th, 1937. (496860.)

10907. "Process for the manufacture of anode plates for lead electric storage batteries." International Latex Processes, Ltd. May 8th, 1937. (Addition to 482858.) (496794.)

12443. "Rectifier units." P. R. Mallory & Co., Inc. April 26th, 1937. (496797.)

14363. "Bases and leads for electron-discharge tubes." C. Lorenz Akt.-Ges. May 13th, 1937. (496802.)

14537. "Circuit arrangements for telegraph systems." C. Lorenz Akt.-Ges. May 15th, 1937. (496926.)

14538. "Gilding grids for electric-discharge tubes." Vereinigte Gluhlampen und Elektrizitats Akt.-Ges. May 15th, 1937. (496864.)

15912. "Recording of sound and like oscillations." Naamlooze Vennootschap Philips' Gloeilampenfabrieken. June 25th, 1936. (Divided out of 495124.) (496928.)

16007. "Construction of envelopes and electrode conductors for electric discharge tubes." Naamlooze Vennootschap Philips' Gloeilampenfabrieken. May 31st, 1937. (496803.)

16612. "Electrical supply or distribution systems, particularly for use in coal mines or other explosive atmospheres." J. Fodor. June 3rd, 1937. (Divided out of 15461/37.) (497075.)

17470. "Construction of electrical socket elements as employed in electrical coupling and fuse assemblies." L. E. W. C. N. Davey. June 11th, 1937. (Divided out of 16300/37.) (496868.)

TRADE MARK APPLICATIONS

THE following are among the recent applications for British trade marks. Objections against any of the proposed marks may be entered within one month from December 28th last:—

Aero. No. 601798. Class 8 (IV). Electric shaving instruments.—G. & M. Lane, Ltd., 24, Ludgate Hill, E.C.4.

Synolan. No. 600763. Class 9 (IV). Non-insulation parts and fittings for electric switches, all made of mouldable plastic substances.—O. C. Hawkes, Ltd., Globe Works, Bromsgrove Road, Birmingham.

Rotostat. No. 601250. Class 9 (IV). Thermostats and temperature measuring instruments.—The British Rototherm Co., Ltd., Trafalgar Works, Station Road, Merton Abbey, S.W.19.

Winter Cavalcade

With reference to the indoor ski-ing entertainment at Earls Court, the electrical plant for which was described in our issue of December 9th, the British Thomson-Houston Co., Ltd., informs us that B.T.H. lighting is employed throughout. "Mazda" lamps are used for the arena and ski-ing slope, while the fluorescent effects in the ballet are produced by means of "Mercra" ultra-violet lamps in special projectors.

CONTRACT INFORMATION

Particulars of work for which tenders are invited, contracts placed, and building schemes promising work for electrical contractors and traders

Contracts Open

Where "Contracts Open" are advertised in our "Official Notices" section the date of the issue is given in parentheses. Further details of items marked with an asterisk can be obtained from the Department of Overseas Trade (Inquiry Room), 35, Old Queen Street, London, S.W.1.

Aylesbury.—January 30th. Electricity Department. Electrical apparatus and materials for twelve months. (See this issue.)

Birmingham.—January 11th. Salvage and Stables Committee. Fifteen lead-plate batteries for electric refuse collection vehicles. (December 23rd.)

January 16th. Eight electric battery driven vehicles. General manager, Salvage Department, 161, Corporation Street (deposit £1 1s.).

Blackpool.—January 23rd. Corporation. Stores and materials for twelve months. (See this issue.)

Bootle.—January 30th. Watch Committee. Sodium and mercury electric discharge lighting. (See this issue.)

Bradford. — January 14th. Electric lighting and heating installation at the Technical College extensions. Town Clerk, Town Hall.

Cardiff.—January 16th. Electricity Department. Six 1,000-kVA transformers. (December 30th.)

Clydebank. — January 10th. Town Council. Electrical work in 210 houses on the Mountblow housing estate. Town Clerk (deposit £1).

Damascus.—January 12th. Gutmann & Co., P.O. Box 332. Twenty tons of semi-pliable, 2½- and 3-millimetre size telephone wire.

Dublin. — January 18th. Electricity Supply Board. P.i. cables for twelve months. (December 23rd.)

Erith.—January 23rd. Electricity Department. Wiring and installation of emergency lighting equipment, plant and tools for workshop, neon sign equipment and 16-mm. projector sound apparatus and screen for new electricity offices and showrooms, Peir Road. (See this issue.)

Farnworth.—January 26th. Electricity Department. Low-voltage p.i. cables. (See this issue.)

Fraserburgh. — January 12th. Town Council. Electrical work at fifty-six houses. Town Clerk (deposit £1).

Gloucestershire. — Education Committee. Electric lighting in new infants' council school at Kingswood, Bristol. County architect, Shire Hall, Gloucester.

Hastings.—January 25th. Electricity Department. Stores and materials for periods of one, two, and three years. (See this issue.)

Hull.—January 17th. Electricity Department. Stores and materials for twelve months. (December 30th.)

Inverness.—January 6th. Electrical installation at Lovat Scouts Headquarters. Secretary, Territorial Army Associations, 57, Church Street.

India.—January 31st. Steel rolling mill with electrical equipment. Director-General, India Store Department, Belvedere Road, London, S.E.1 (deposit 5s.).

London.—H.M. OFFICE OF WORKS.—January 20th. Switchgear, transformers, &c., for sub-station at Glascoed R.O.F. (December 30th.)

January 27th. Extra-high-voltage switchgear, batteries, &c., at Glascoed R.O.F. Extra-high- and low-voltage switchgear, cables, batteries, &c., at Pembrey R.O.F. (See this issue.)

January 20th. Propeller driving motors and motor-generator set for the National Physical Laboratory, Teddington. (See this issue.)

January 27th. Low-voltage and telephone cables for Chorley R.O.F. Heapey Depôt. (See this issue.)

STOKE NEWINGTON. — January 12th. Electricity Department. Extra-high-voltage and low-voltage cables and cable laying, cookers, kettles, wash-boilers, water heaters, cooker control units, conversion to AC of DC radio apparatus, solder, wiring on consumers' premises, house service meters, underground disconnecting boxes, plumbing and fixing water heaters and meter boards for twelve months. (December 30th.)

HAMMERSMITH.—January 25th. Borough Council. General electricity stores for twelve months. (See this issue.)

BETHNAL GREEN.—January 27th. Electricity Department. Glazed earthenware ducts, electric lamps, 250-V v.i.r. and lead-covered cable, joint and cable box compound, switches, lampholders, glass shades, dry batteries, torches, conduit and fittings, service boxes, meters, high- and low-voltage cables and electric cookers. (See this issue.)

Liverpool. — January 13th. Electric Supply Department. Materials for twelve months. (December 30th.)

January 11th. Eighteen 1,000-kVA and alternatively eighteen 1,250-kVA step-down transformers. (See this issue.)

Manchester.—January 18th. Electricity Committee. Domestic electric cookers for twelve months. (December 30th.)

January 26th. Reserve water tank and pipework and 300-Ah battery and charging equipment for Barton power station. (See this issue.)

Morecambe and Heysham.—January 9th. Electricity Department. Six 400-kVA transformers. (December 30th.)

New Zealand.—WELLINGTON.—February 3rd. Posts and Telegraph Department. Quantities of telephone cable. (T. 30104/38.)*

January 31st. Public Works Department. Cable. (T. 30679/1938.)*

February 21st. Four 250-kVA single-phase transformers. (T. 30678/38.)*

Northumberland. — County Council. Installation of electricity in the Belford Senior School. Plans by W. W. Tasker, county architect, County Hall, Newcastle-on-Tyne.

Portsmouth.—January 23rd. Electricity Undertaking. High-voltage cables and fire protection equipment for 6.6-kV switch house. (December 30th.)

Rhyl.—January 24th. Electricity Department. Low-voltage cables, cut-outs and meters for twelve months. (See this issue.)

South Africa. — PRETORIA. — January 18th. Electric Supply Department. Forty-five 10-kVA, forty-five 20-kVA and ten 50-kVA transformers. (T. 30437/38.)*

January 25th. City Council. Lighting fittings and auxiliaries for trolley-bus poles and 1,300 ft. of high-voltage cable. (T. 30539/38.)*

February 9th. Union Tender & Supplies Board. One 50-V switchboard and associated equipment. (T. 30622/38.)*

JOHANNESBURG. — January 18th. City Council. 260 10-A, 220-V house service electricity meters. (T. 30264/38.)*

January 28th. Portable AC electric welding set. (T. 30436/38.)*

January 11th. Railways and Harbours Administration. Four 450-A, single arc portable welding machines. (T. 30528/38.)*

PORT ELIZABETH.—January 12th. City Electrical Engineer's Department. Low-voltage cables, tubular steel poles and street-lighting fittings. (T.Y. 30151/38.)*

Southend-on-Sea.—February 9th. Electricity Department. General stores for twelve months. (See this issue.)

Stranraer.—January 18th. Town Council. Electrical fittings at 100 houses. Town Clerk (deposit £1).

Torquay. — January 10th. Borough Council. Complete pumping installations comprising four, two and three pumps, together with electric motors and control equipment, pipes, steel floors, crane and all necessary accessories. H. A. Hield, Town Clerk, Town Hall (deposit £5 5s.).

Uruguay.—MONTEVIDEO.—January 11th. State Electricity Supply and Telephones Administration. Various metering instruments and apparatus. (T.Y. 30102/38.)*

West Hartlepool.—January 18th. Electricity Department. Five 300-kVA transformers. (December 30th.)

Wick.—January 9th. Town Council. Electric lighting works at eighty houses. Town Clerk (deposit £2 2s.).

Worcester.—January 13th. Town Council Electrical installation at eight shops and houses on the Tolladine estate. Town Clerk, Guildhall (deposit £1 1s.).

Orders Placed

Aberdeen.—Town Council. Accepted. Electric lighting at Tullos housing estate (£413).—A. McRobb.

Education Committee. Accepted. Electrical work at Sunnybank School extensions (£530).—A. McRobb.

Housing Committee. Recommended. Electrical work at housing estate (£822). —R. A. Mair. Electrical work at Garthdee housing estate (£211).—J. B. Reid.

Barrow-in-Furness. — Electricity Committee. Accepted. Erection of overhead lines to High Newton and Field Broughton (£4,196).—Johnson & Phillips (Manchester).

Birmingham.—Electricity Department. Accepted. Electric kettles for twelve months.—Mayall & Co.

Bridlington. — Electricity Committee. Accepted. Additional apparatus for the testing of three-phase meters.—Measurement, Ltd.

Dalbeattie.—Town Council. Accepted. Electrical work at housing estate (£160). —R. Dunn & Sons.

Eston.—Electricity Committee. Accepted. Cable (£523).—Hackbridge Cable Co.

Fort William.—Town Council. Accepted. Materials in connection with the AC electricity supply: Switchgear. —Johnson & Phillips. Transformers.—Bonar Long & Co. Main cable and overhead lines.—Fraser & Borthwick. Meters.—British Sangamo.

Glasgow.—Transport Committee. Accepted. Dry cells.—Standard Telephones & Cables. Lamps.—B.T.H.; Met.-Vick. Electrical Co.; G.E.C.

Lyceum Cinema. Accepted. Electrical installation.—W. C. Martin & Co. Claudgen neon installations.—G.E.C.

Grimsby.—Cleansing Committee. Recommended. Electric vehicle battery (£154).—Chloride Electrical Storage Co., Ltd.

Electricity Committee. Recommended. Cables for twelve months (£8,877).—Scottish Cables. Switchgear unit (£440).—Reyrolle & Co.

Ilford.—Electricity Committee. Accepted. 500-kVA transformers: Three (£510 each) and one (£525).—Ferranti, Ltd. Three (£510 each) and one (£525).—British Electric Transformer Co.

London. — COUNTY COUNCIL.—Wiring and fittings for electric lighting in a block of dwellings on the Garford Street site, Poplar:

	£
Newman & Watson, Accepted	**662**
Archibald Meckhonik	716
Ernest W. Meredew...	719
Jacob, White & Co....	742
Buchanan & Curwen	749
W. H. Gaze & Sons	754
Ilford Electrical Co....	765
City Electrical Co.	678
Holliday & Son (Electrical)	730
Henfrey (Electrical)...	801
Blackburn, Starling & Co.	806
Springvale Electrical Co.	811

Wiring and fittings for electric lighting in block of dwellings on the Princess Street site (Silestone estate), St. Marylebone:

	£
Newman & Watson. Accepted	**581**
Jacob, White & Co....	596
Archibald Meckhonik	606
Springvale Electrical Co.	609
Samuel Reed & Sons	620
Read & Partners	645
Buchanan & Curwen	648
Ilford Electrical Co....	761
Electrical Installations	798

Electrical installation at the Shoreditch Technical Institute, Curtain Road:

	£
Pinching & Walton. Accepted	**1,684**
A. J. Hewens & Sons	1,702
Samuel Reed & Sons	1,739
Berkeley Electrical Engineering Co.	1,783
T. Clarke & Co.	1,793
Buchanan & Curwen	1,822
Newman & Watson	1,842
E. & C. Champion	2,126
Colston Electrical Co.	2,346
Johnson & Tanner	2,375

Manchester. — Electricity Committee. Accepted. 33-kV, three-phase, AC switchgear.—Asea Electric. Supervisory equipment for control of sub-stations.—Standard Telephones & Cables. One 120-kW mercury arc rectifier equipment.—B.T.H. Co. Two sub-station kiosks.—Standard Switchgear. Feeder protective equipment.—A. Reyrolle & Co.

Education Committee. Accepted. Alterations and additions to electrical installation at Mobberley boys' school.—N. C. Bailey & Co.

Middlesbrough.—Town Council. Accepted. Electric cables.—B. I. Cables.

Pewsey.—R.D.C. Accepted. Installation and service of electric lighting at the Council houses at North Tidworth (£296).—R. O. Foote.

Sheffield. — Electricity Committee. Accepted. Three transformers for Liverpool Road sub-station (£828).—Electric Construction Co.

Smethwick.—Estates Committee. Accepted. Electrical installation at Rolfe Street baths (£14).—Walker & Co.

Stalybridge. — Stalybridge, Mossley, Hyde and Dukinfield Joint Electricity Board. Accepted. Extensions at Hartshead power station: Additional feeder protection in the Mossley area, including the necessary switchgear.—Ferguson, Pailin. Heating apparatus, air-conditioning plant and pipe-work.—W. F. Spencer. Electrode circulator.—Bastian & Allen.

Sunderland.—Town Council. Accepted. Electric lighting fittings: Commercial Road school extensions (£106) and Sir John Priestman Library Technical College (£217).—Hailwood & Ackroyd.

Town Council. Accepted. Cables.—Aberdare Cable Co., Ltd.; Durham Cables, Ltd. Lamps and cookers.—G.E.C. Meters.—British Sangamo Co.; Ferranti, Ltd. Wash boilers.—Burco. Water heaters.—Reyrolle & Co. Irons.—Revo Electric Co.

Warrington.—Health Committee. Accepted. Electrical equipment at Aikin Hospital laundry.—C. H. Charters.

Weymouth.—Fire Brigade Committee. Accepted. Electrical installation at fire station (£470).—Davis & Hadley.

Woolwich.—Borough Council. Accepted. Installation of switchgear at the generating station (£6,677).—B.T.H. Co.

York.—Highways Committee. Accepted. Internally illuminated signs (£368).—Amcolite, Ltd.

Contracts in Prospect

Aberdeen.—Extensions, Maternity Hospital (£27,500); medical superintendent.

Bakewell.—Houses (30), Earl Sterndale; W. Hodgkinson, Earl Sterndale, near Buxton.

Banbury.—Houses (52), Orchard Way estate; R. W. Messenger.

Barnard Castle. — Houses, Copley; R.D.C. surveyor. Shops and offices, Wetherell, Dent and Pickersgill, architects, Lloyds Bank Chambers.

Barnsley.—Houses (58), Burton Lane; borough surveyor.

Barry. — Factory buildings, Cardiff Road, Cadoxton; Marine Chemical Co., Ltd.

Bexley.—Fire station and ambulance depôt, Bexleyheath (£20,000); borough surveyor.

Billingham-on-Tees. — Fire station (£10,000) and houses (£40,000); J. J. Hill, U.D.C. surveyor.

Birkenhead. — Tenements (255) and houses (72); borough surveyor.

Birmingham.—Drill Hall, Haslucks Green Road, Shirley; William Jackson, Ltd., builders, Langley Green. Nurses' hostel, Ludgate Hill; E. W. Turner, architect, Exchange Buildings, Stephenson Place.

Brierley Hill.—Houses (78), Bromley Pensnett, for the U.D.C. Municipal buildings (£44,000), for U.D.C.; R. H. J. Comber, surveyor.

Brighouse. — Houses (96), Lillands Avenue, for the T.C.; Gibson Brothers, builders, Upton, Pontefract.

Bristol.—Depôt (£36,310); city engineer.

Cheltenham. — Estate development, Hampston Villa Farm, Shurdington Road; L. W. Barnard & Partners, architects. Extensions, Town Hall (£91,412); borough engineer.

Chesterfield.—Houses (21), Brookland Drive, Brook Bank Avenue; F. Longden, 138, Ashgate Road.

Chester-le-Street.—Houses, in connection with slum clearance; U.D.C. surveyor.

Coventry.—School, Stoke (£55,886), for the E.C.

Croxley. — Houses (68), Canterbury Road, Durrants estate; Croxley Estates, Ltd.

Croydon.—Extensions to factory at 81, Morland Road, Addiscombe; Hounsfield & Co., Ltd.

Darlington.—Houses, Hurworth Place; R.D.C. surveyor.

Doncaster.—School, rear of Lonsdale Avenue, for the E.C.; T. H. Johnson & Son, architects, 19, Priory Place.

Dumbarton. — Houses (50), Geils Avenue; Lawrence (Glasgow), Ltd.

Durham.—Schools, Wall Nook, Langley Moor, Ford, Hetton and Kibblesworth and additions to High Spen school, for the County E.C.; county architect, 34, Old Elvet.

Eire (DUBLIN).—Houses (28), Belton Park; P. Belton.

Elstree.—Development of estate (117 acres), Great North Road; J. Laing & Son, Ltd., Bunns Lane, Mill Hill.

Essex.—Staff cottages, Mental Hospital, Brentwood (£5,663), and enlargement of school, Manningtree (£8,204); county architect.

Glasgow. — Extensions to premises, Strathcona Street; Barr & Stroud, Ltd.

Grangemouth.—Houses (158), for T.C.; burgh surveyor.

Grimsby.—Council offices (£36,501); Wilkinson & Houghton. School, Nunsthorpe (£14,944); Taylor & Coulbeck.

Hanworth.—Bakery and stores, Twickenham Road, for Price & Co., Ltd.; M. W. Hudson, architect, Northumberland Avenue, Wanstead.

Hawarden.—Houses (190); R.D.C. surveyor.

Hendon.—Fire station and firemen's dwellings (£63,000), Golders Green; A. O. Knight, architect, The Burroughs, London, N.W.4.

Hereford.—Block of shops, College Road estate; Nicholson & Scriven, architects, Cathedral Chambers, King Street.

Hornsey. — Flats (94), Woodlands, Crouch End Hill; I. Schultz, architect, 101, Alexandra Road, London, N.W.8.

Ilford.—Houses (52), Chadacre Avenue; Lord & Mellowdew, Ltd., Estate Office, Longbridge Road, Barking. Houses (29), Chalgrove Crescent; B. C. Tappin, 35, Lyndhurst Gardens. Houses (41), Franklyn Gardens; W. M. Edwards, Rivington, Hornchurch Road, Romford. Flats (50) and houses (15), Brunswick Gardens; Davis Estates, Ltd.

Leeds.—First section central market (£250,000), for Markets Committee; borough surveyor.

Leicester.—Cinema, Saffron Lane, for Knighton Cinemas, Ltd.

Liverpool.—Flats (200), between West Derby Street and Fairclough Lane, flats (1,200) and three schools, Warwick Street, Toxteth; and community centre, Townsend Avenue, Norris Green (£30,000), with electrical work; L. H. Keay, director of housing. Houses (44), Bowring Park estate, Roby, with electrical work; Evans & Howarth, builders, 27, Druidsville Road. Houses (30), Thingwall Farm estate, Hilary Avenue, Roby, with electrical work; Milton Estates, Ltd., Childwall Fiveways, Queen's Drive.

Llanelly.—Factory, Dafen, for the Vitreflex Co., Ltd.

London.—(CAMDEN TOWN).—Extensions to printing works, Wicklow Street, for Co-operative Press, Ltd.; L. G. Ekins, architect, 99, Leman Street, Stepney, E.1. (CANNON STREET, E.C.4).—Extensions to London Chamber of Commerce Building (£100,000); Gunton & Gunton, architects, Empire House, St. Martin's-le-Grand, E.C.1. (HIGHGATE).—Cinema, Junction Road (£60,000), for the Odeon Cinema Holdings, Ltd.; T. P. Bennett & Son, architects, 43, Bloomsbury Square, W.C.1.

Longton (STAFFORDSHIRE). — Houses (36), Charles Street; W. C. Beech & Co.

Malden.—Engineering works and garage, Beverley Way; L. F. Peaty & Co., Ltd., Beverley Way.

Manchester.—Girls' school, Rusholme; Robert Carlyle & Co., builders, Trafford Park. Enlargement of Old Hall Drive school (£42,963), for the E.C.

Mansfield.—Houses (10), Rosebery Hill; F. Mann.

Matlock.—Store premises, Dale Road, for F. W. Woolworth & Co., Ltd.

Milford Haven.—Swimming pool; W. A. Evans, consulting engineer.

Morecambe.—Houses (20), Bateman Road; Coates & Flaxington.

Newbury.—Houses (15), Valley Road; W. S. Puller.

Newcastle Emlyn.—Houses (34), for R.D.C.; Ewart James, Birch Court, Llanbyther.

Newcastle-on-Tyne.—A.R.P. cleansing station and decontamination depot, Newington Road; R. G. Roberts, 18, Cloth Market. Hotel, Benton Road, for Blayney & Co., Ltd.; Hetherington and Wilson, architects, County Chambers, Westgate Road. Tramway offices, Union Road, for the City Council (£2,500); J. and W. Lowry, builders, Corporation Street. Upholstery works, Barrack Road, for J. Taylor, Dunford and Co.; P. L. Browne, Son and Harding, architects, Pearl Buildings. Alterations to premises, Messrs. Mawson, Mosley Street; Cackett, Burns, Dick and McKellar, architects, Ellison Place.

Newhaven.—Development of Bishopstone estate; D. B. Gray & Partners, surveyors, Mount Street, London, W.1.

Northern Ireland.—(BELFAST).—Reconstruction of Yorkshire House, for Yorkshire Insurance Co. (£100,000); R. H. Gibson, architect, Scottish Temperance Buildings, Donegall Square South.

Northumberland.—Police station, Willington Quay, for the C.C. (£6,600); A. R. Robertson, builder, Blyth.

Oldham. — Two schools, Chadwick Street, for the E.C.

Pagham (SUSSEX). — Houses (298), King's Beach estate; Constable & Maude, surveyors, Mount Street, London, W.1.

Rochdale.—Isolation hospital, Birch Hill (£85,000); borough surveyor. Modernisation of King's Cinema, Kingsway, Oldham Road (£8,000); Drury & Gomersall, architects, Oxford Road, Manchester.

Scunthorpe.—Houses (250), Western Boundary, with electrical work; Spilman & Robertshaw, builders, 4, Ashby Road. Extensions, War Memorial Hospital (£70,000); Elcock & Sutcliffe, architects, 60, Strand, London, W.C.2.

Sheffield.—Houses (48), Strutt Road; C. W. Alflat, 32, Kingfield Road.

Shropshire.—Schools, Ellesmere; A. G. Chant, county architect, 5, Belmont, Shrewsbury.

Smethwick.—Houses (20), at the junction of Abbey Road and Alexander Road; R. Fletcher, borough engineer. Houses (52), Stanhope Road; W. Cooper & Son, Ltd. Flats (26), Gladys Road; Housing, Ltd. Extensions to foundry, Rolfe Street; A. E. Griffiths, Ltd. Extensions to premises, Bridge Street; Smethwick Drop Forgings, Ltd.

Southall.—Clinic and nurses' home, Southall-Norwood Hospital, Portland Road; Governors.

South Shields.—Isolation hospital for the T.C. (£95,000); G. Bailey, Ltd., contractors, King Street.

Stockport.—Houses (72), Broadstone Hall Road, South Reddish, Breastford Road and Craven Road, Reddish; J. A. Bateson & Co., Ltd., builders, 15, Birkdale Road.

Stratford-on-Avon.—Fire station; borough surveyor.

Sunderland.—Three blocks of flats, Springwell Farm estate, for the T.C.; borough engineer.

Sutton Coldfield.—Houses (13), near Green Lane; F. Spencer.

Urmston. — Houses (71), Sherbourn Road and Kirkstall Road, Davyhulme; A. Locke, Ltd., Lostock Road, Davyhulme.

Wallsend-on-Tyne. — Maternity and child welfare centre scheme, The Green (£17,950); borough surveyor.

Warrington.—Houses (153), Pinmill Brow, Church Street and Flinn Lane, Frodsham; Atlas Building & Construction Co., Wilderspool Causeway. Extensions to works, Ellesmere Street; T. Locker & Co., Ltd.

West Bromwich.—Houses (40), Church Lane estate; W. R. Kemp. Maternity block, Hallam Hospital (£17,125); J. & F. Wootton, Ltd.

Weymouth.—Houses (12), Broughton Crescent; Smith & Lander. Houses (11), Goldcroft estate; R. W. Vine. Houses (11), Links Road; James Bros., Ltd. Houses (10), North Side Road; W. Knell.

Whitchurch.—Extensions to works, Davis Products, Ltd.

Winlaton (Co. DURHAM).—Houses (20); N. T. Barker, builder.

Winslow.—Houses (32), for R.D.C.; R. C. White, housing architect.

Woking.—Maternity home (£30,000), for Woking Health Society; Saxon-Snell & Phillips, architects, 9, Bentinck Street, London, W.1.

York.—Houses (10), Heworth Green; H. Williamson. Houses (10) and flats, Beech Avenue; Ainsty Building Estates, Ltd. Additions to premises; Prudential Assurance Co., Ltd.